SCIENTIFIC AMERICAN SUPPLEMENT. No. 1140

Scientific American, established 1845.
Scientific American Supplement, Vol. XLIV. No. 1140. NEW YORK, NOVEMBER 6, 1897. Scientific American Supplement, $5 a year.
Scientific American and Supplement, $7 a year.

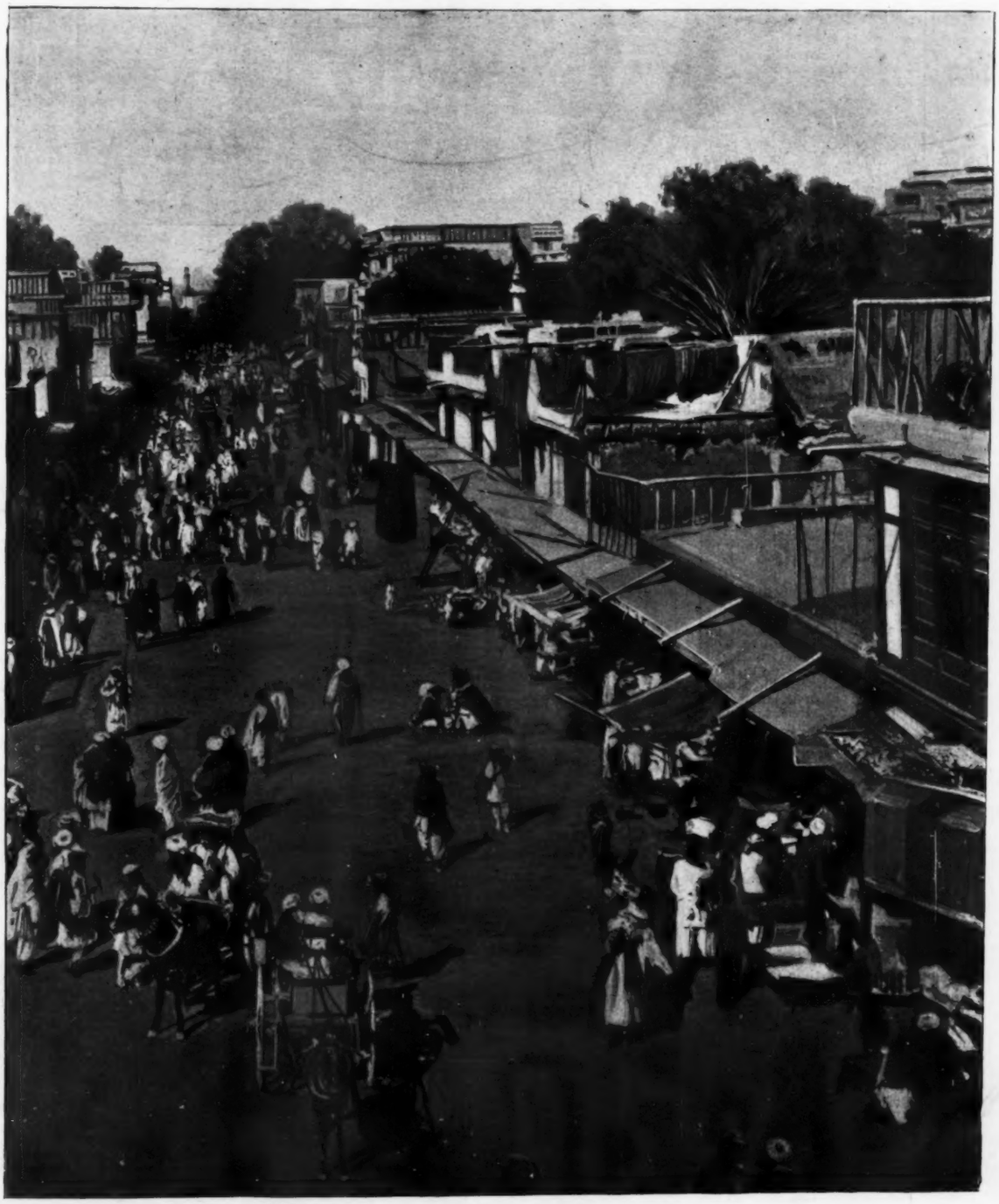
THE EAST INDIA FRONTIER TROUBLES.

WE present with this article several views of localities in those parts of British East India which have recently been disturbed by native risings.

One of these cuts shows a street in the city of Peshawur, itself at one time in danger of insurrection by its Oriental population. From here troops were sent to the aid of the garrison at Shabkadar, when a band of rebels nearly eight times superior in number to the English came very near forcing these to surrender.

Another place of interest is shown in our fourth illustration. It is the Khyber Pass, which played so important a part in the rebellion. For this and the other engravings we are indebted to Illustrirte Zeitung.

We have also a reproduction from a photograph of some Khyber rifles. These troops the English authorities thought it best to disarm, although no open signs of disloyalty were given. These and other details are, however, well known to our readers through the newspapers, and we do not purpose to dwell upon them at length. Small as may seem the immediate significance of these troubles, they bear upon relations of supreme importance to at least two of the great European powers. We are referring to the position in which Russia and England find themselves to-day in Asia. At the end of the last century Anglo-Russian affairs in Asia had a very different aspect from the present state of things. There extended then between them the whole of China on one side, and Turkestan, Persia and Afghanistan on the other. But the year 1796 brought the first of those changes which gradually brought the Russian frontier within a comparatively short distance from English territory. This first step forward by the Russians was invited by request on the part of the King of Georgia for help against the Persians. Catherine the Second, then on the throne, granted the aid, and went further, taking Derbent near the Caspian Sea, Daghestan, and nearly all the land to the river Kur. Georgia was formally placed under Russian protectorate soon after, to be annexed to the great empire. In the early years of the nineteenth century the first step was followed up by the taking from the Turks of the mouth of the river Phasis, and a little later by the annexation of the Persian province of Shirvan, and of Armenia from beyond the Kur to the Aras and Mount Ararat. Thus the barrier of the Caucasian Mountains



THE INDIAN UPRISING—STREET IN PESHAWUR.

was passed by. Besides, these conquests gave the Russians a most advantageous position from which to conduct operations against Turkey in Asia and Persia, and to guard the Caspian Sea and the Black Sea. For years the inhabitants of the mountainous districts held their liberty. But, in the year 1859, Shamyl, the Caucasian hero, after having ruined ten Russian armies, was taken prisoner, and with him fell the cause he had fought for. Thus Russia possessed, south of the Caucasus, eight large provinces, backed on one side by the mountains held by her troops, and protected on the flanks by two seas and strong fortresses. Thus a strong advanced post of the Russian empire was formed, whose center was at Tiflis.

In the meantime the English on their side were also advancing in the opposite direction. In 1816 they compelled the mountain kingdom of Nepaul to acknowledge their supremacy, and two years after Dekhan was reduced to the same dependence. Each of these states received at its royal court an English officer, who watched the king's movements, and at the capital was stationed a British garrison to insure obedience. The pay of this garrison was derived from the taxes levied in certain portions of the king's realm. Thus the English could keep a numerous army without going to any expense.

In 1824 to 1826 two hundred miles of coast in Burma were acquired, the state of Assam became tributary to Great Britain, as did Singapore and Malacca. This made the Gulf of Bengal a British sea, and placed the great commercial road to India and China in the hands of the great colonizing nation.

The next move on the part of Russia was almost directly aimed at the English. The Czar prevailed on his vassal, the King of Persia, to make an attack on Herat, one of the two great cities on the frontier of India and Persia. The first attempt was made in 1833, but without success. Again the Shah sent his troops to Herat four years later, but with the same result. In the next year a third expedition was made, for which the Czar supplied the Persian army with officers, to conduct the siege. England was jealously watching these movements. When the Persian army arrived at their destination, they found the fortress occupied by an English garrison. Forces were also posted in the immediate neighborhood. Against such odds the Shah dared not to continue in his original plans, and he had to retreat. This was in 1838. The event represented a severe check to the Russians. They tried in the following year to make up for the defeat by an attack on Khiva, a town on the second great Indian road. But the army had to cross vast deserts, and nearly all perished on the way.

So far, the English had an indirect advantage. But in 1842 came the Afghan war. Fifteen thousand Englishmen were massacred in the enemy's territory. A new army was sent to avenge the defeat, but it became clear that it was unsafe for the English to venture too far from their peninsula. Since that time it has been their general policy to assume a defensive position, making Herat their outpost, while the Russians have steadily advanced, taking all the most important towns of Turkestan, even Samarkand, one of the ancient Asiatic capitals, and Gouldja, the chief city of Jungarh, which holds some important mountain passes. Thus the two powers, Russia and England, are brought very near each other, and naturally any check received by one is an advantage to the other. It is in this sense that the Indian frontier risings assume a rather important aspect. The Standard speaking of these matters says: "The inner condition of India is not so favorable as that we may with confidence look forward to a costly war at the frontiers."

Just the district where the recent troubles occurred lies at the very point where Russian and English interests meet. Not a hundred miles away the land is the Czar's. These circumstances make the late outbreaks in the far East a link in a chain of events which seems to be gradually moving toward a climax which may prove a point of great issue in the world's history.

To cut glass take a piece of thin, strong thread, soak it with kerosene, methylated spirits or turpentine; then lay it firmly round the portion where the cut is to be made, light the thread and turn the glass so that the flame is below. On pouring water over the glass you will obtain a clean cut where the thread was laid.—Uhland's Wochenschrift.

A TWO WEEKS' TRIP WITH ESKIMO DOGS.*

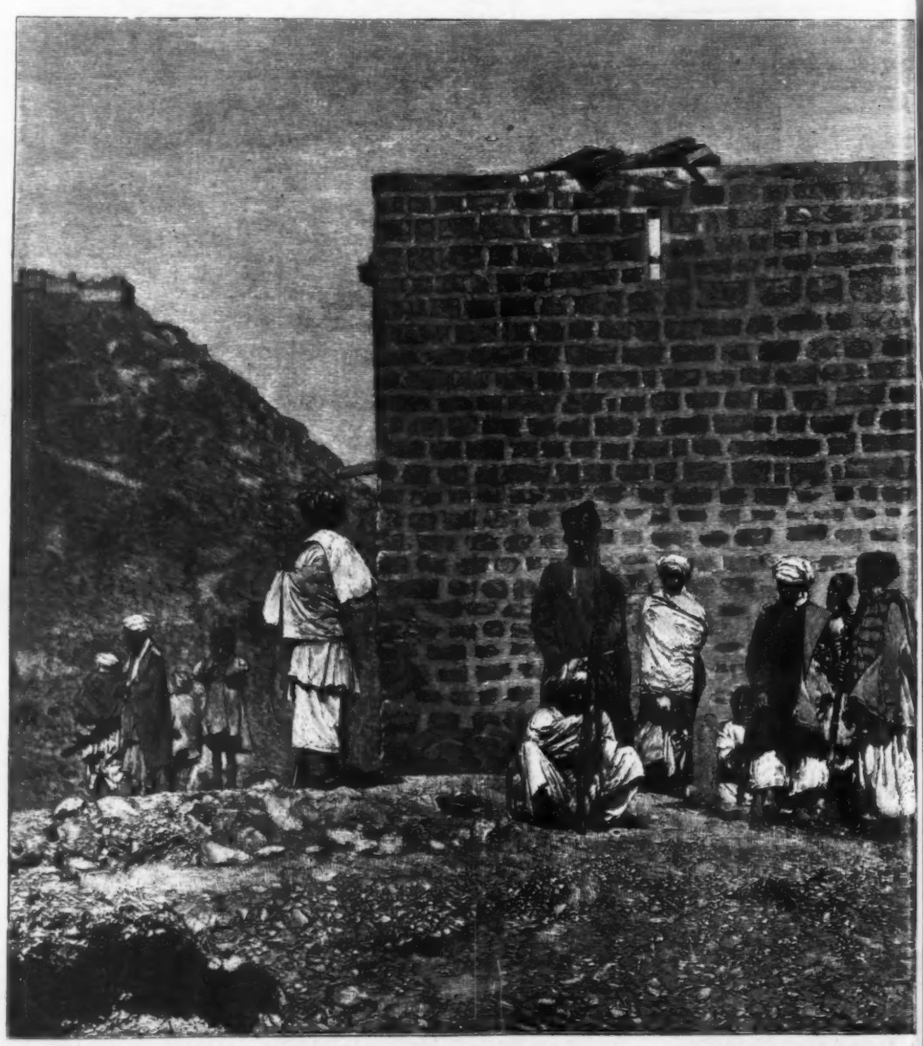
By the Rt. Rev. JERVOIS A. NEWNHAM, Bishop of Moosonee, B. N. A.

ONE does not generally expect hardship on a seaside trip, yet I expected some. I was to go some fifteen miles down a great river to the bay, then two or three days along the bay, and then ten miles up another big river, and to return the next week the same way. This I have done, traveling for two days each way over the salt water, and yet neither seeing nor smelling it, and traveling over the water by a train! I traveled by train, yet not on wheels, a train which made its own track and did not use fuel or water, and only went at the rate of four or five miles an hour, and only from about 5 A. M. to 2 or 3 P. M. each day. The rest of the time we spent in camp. For those three days and nights we were in the open air, and at what a temperature! Always far below zero, 45 or 50 degrees of frost by day and as much as 60 or 62 at night! A strange seaside trip, surely! But before telling my story, let me explain the above riddle by saying that the "train" was a dog train, composed of a sled drawn by eleven Eskimo dogs, and driven by an "Injun," not an injuneer—I mean an engineer; and that we traveled over the ice, three feet thick, with two feet of snow on top, which entirely hid the salt water, so that we could only travel by daylight, and had to stop at certain fixed places, where we could find wood for the campfires, and that we slept on the ground, or rather snow, in our cotton tent, or in the wigwams or tents of poles and bark, erected at the regular stopping places.

My home is at Moose Fort, and I wished to visit our mission at Rupert House, confer with the missionary there and see the residents. On the twenty-sixth of February the dogs from Rupert House arrived here and brought me an invitation to return with them,

* From the Independent.

BRITISH ARMY—NATIVE ARTILLERYMEN.



KHYBER RIFLES.

which I gladly accepted, and made my preparations. These consisted in getting suitable food cooked for three or four days, gathering a bundle of blankets and rabbit skin rugs to wrap round me in the sled and sleep on at night, packing a small box with clothes, etc., for use at Rupert House, and looking out my deerskin coat and snowshoes. The food needs to be very simply and ready cooked; for we do not stop during the day to cook, and at night we have to thaw our food, and again in the morning. I took a loaf and some scones, the latter mostly to carry in my pocket and eat at midday; some partridges ready cooked, a little cooked beef and bacon, and a packet of soup powder; also tea and sugar, salt and butter, some frozen cream, frying pan, kettle, cup, plate, etc. Monday, the twenty-second of March, I was up soon after four o'clock, only to find a snowstorm raging, so that I could lie down to await developments. At seven o'clock the storm was so heavy that we abandoned the idea of starting that day. The snow fell all day, the worst storm of the season. So we knew we were in for a hard trip.

Tuesday I was up at 5:30, and after a hasty breakfast, donned my "Husky" coat of deerskin with the hair on and started for the dogs. It was a fine morning, but promised to be very cold all day, and the wind right in our teeth. Well, here we are down on the ice, and the dogs all harnessed and impatient to start. Let me describe. The sled consisted of a narrow box four feet long, the front half being covered or

FORT ALI-MUSJID, KHYBER PASS.

boxed in, mounted on a floor eight feet long resting on runners. In this box the passenger sits wrapped in rabbit skin so that he can hardly move, his head and shoulders only projecting. In front and behind and on top of the box is placed all the luggage, covered with canvas and securely lashed to withstand all the jolting and possible upsets, and our snowshoes within easy reach. An important item is the dog whip, terrible to the dogs if used by a skillful hand and terrible to the user if he be a novice; for he is sure to half strangle himself or to hurt his own face with the business end of the lash. The whip I measured had a handle nine inches long and lash thirty feet, and weighed four pounds. The lash was of folded and plaited seal hide, and for five feet from the handle measured five inches round, then for fourteen feet it gradually tapered off, ending in a single thong half an inch thick and eleven feet long. Wonderful is the dexterity with which a driver can pick out a dog, and almost a spot on a dog, with this lash. The lash must be trailing at full length behind, when a jerk and turn of the wrist causes it to fly forward, the thick part first and the tapering end continuing the motion till it is at full length in front, and the lash making the fur fly from the victim. But often it is made to crack like a pistol over the heads of the dogs as a warning. The eleven dogs were harnessed to the front of the sled, each by a separate thong of seal hide, all of different lengths, fastened to a light canvas harness. The nearest dog was about fifteen feet from the sled and the leader with bells on her about fifty feet, the thongs thus increasing in length by about three feet. When the going is good the dogs spread out like the fingers of a hand, but when the snow is deep they fall into each other's tracks in almost single file. As they continually cross and recross each other, the thongs get gradually plaited almost up to the rearmost dog, when a halt is called, the dogs are made to lie down, and the driver carefully disentangles them, taking care that no dog gets away meanwhile. They are guided by the voice, using "Husky," i. e. Eskimo words: "Owk!" go to the right, "Arrah!" to the left, and "Hoit!" straight on. But often one of the men must run ahead on snowshoes for the dogs to follow him. See me now in my box, carefully wrapped up, all but my face, in blanket of plaited rabbit skins, a jerk is given to the sled to loosen it, "Hoit!" and we are off! I have often seen the dogs start at a gallop of six miles an hour; but the snow is deep and we go at a slow trot, the men running and helping the dogs. It is slow and cold for me, but gradually Moose Fort is left behind as we go down the river.

At eleven o'clock we halt ten minutes for refreshments. We are in no anxiety lest the train will start before our coffee has cooled enough for us to drink it; our hurry is lest it and the sandwich should freeze before we consume them. An al-fresco lunch sounds very charming, but there are decided drawbacks. Standing or sitting with fifty degrees of frost, the mustache and beard heavily laden with icicles, so that it is difficult to open the mouth without bringing tears to the eyes, by reason of the hairs pulled out, the fingers freezing if they are kept out of the mittens for a few minutes for eating purposes, the bread frozen, or beginning to freeze the moment it is taken from the pocket—these are not the best constituents for a picnic. We never stop to cook in the middle of the day's journey; but a jar of boiling tea has been stowed in the blankets, and has not lost all its warmth, and a sandwich or a scone carried in an inner pocket will not be frozen very hard. On again, and at 1 P. M. we are passing Natatishe Point, twenty-two miles from Moose. We reach the next point, Big Stone, before three o'clock; but as it was twenty-five miles to the next possible stopping place, we had to be content to go no further that day. We had a cotton tent with us, and a small portable stove, and the first thing was to erect these in the shelter of the bush, and to get some wood for the fire. This took some time, and I found the waiting miserably cold work, chilling me to the bone. Of course the floor of our tent, which is also our bed, is the trampled surface of snow, with a few pine branches laid on top. When the fire in the stove was burning my bedding was laid in the tent, and, sitting on this, I proceeded to unpack and thaw my food and to thaw myself. The stove had not been very well put up, and kept up a constant leakage of most pungent smoke, which soon caused me real agony in the eyes. My supper of bread and butter and a bird, ready cooked, needed only to be thawed, and water to be boiled for tea; but the thawing takes long, and it was half past four before it was ready. I also found that partridge shot in December, frozen till March, then cooked and frozen again, thawed and so eaten, is rather dry and uninteresting food. The men were busy cutting dry firewood, attending to the dogs and cooking their supper till later than this. The dogs are unharnessed and chained to trees, out of reach of each other, as they are very quarrelsome, and presently fed with frozen fish, rabbits, or seal blubber, as the case may be. They sleep in the snow, coiled up without any shelter, and get very little attention. A tent with a stove is more comfortable for us than the open wigwam fire in the middle, which is always very bad for smoke. The cotton tent gets almost too hot while the stove is in full draught; but everything in it, except the sleepers, freezes solid at night. It was too smoky for comfort, so, as we had to get up very early, we lay down at eight o'clock. My bedstead was snow, mattress pine branches, bed of rabbit skin and blanket of ditto. I have learned to sleep like an Indian, with head under the blanket; but even so, one gets very cold before midnight, and that and the hard bed made my rest very much broken. I think that the men must have lit the fire very early next morning. About three o'clock I awoke (indeed, I awoke several times before that, owing to the hardness of the bed and the cold), and put all my breakfast materials to thaw; but did not get up finally till four o'clock. It took us till six to thaw or cook our breakfast and eat it, so that we did not start till 6:30.

The day was fine for us, but the snow was deep and soft, making heavy traveling. It was also cut into a succession of ridges by the winds; so that it was like crossing a plowed field diagonally. It was hard on the dogs, hard on the passenger, if he rode, owing to the constant bumping of the sleigh, and very awkward snowshoeing over the ridges. The drivers had to walk the whole way, and I walked for an hour. I had come with borrowed snowshoes, which were too short and tight at the toes, so that I was sore and lame after half an hour. However, I managed two hours' more tramp after lunch, at 10:30, and we reached East Point at noon. It was too late to go on to the next camp (twenty miles at least), so we made for the tent here and were in it by 2 P.M.; very early to stop, but there was no help for it. Here we used the "tent," i. e., not our cotton markee, but a fixture of logs and poles and boughs, about fourteen feet in diameter, and open at the top, through which opening the smoke is supposed to go. One was roasting on the side near the fire, and freezing on the further side. The smoke was dreadful, and very painful to my eyes; I could hardly read prayers for the pain and tears, and was glad to turn into bed at eight o'clock. It was a very cold night (about 65 degrees of frost, or 33 below zero), but I slept fairly well, only felt a little rheumatic and sore from the hard, cold ground. Awaking in the night, I found the hair on my forehead stiff with ice from my breath, and pillow and blankets ditto. Thursday, up at four o'clock and off at 6:15. A bitter morning, and I found the cold while preparing to start almost unbearable; but I got right under my sleigh-robes and dozed. We had to cross two or three small bays, about twenty miles to Cabbage Willows. When half way across an Indian came out to meet us. He reported "no rabbits, and family starving," i. e., very hungry; so we gave him some food from our small store. We found out afterward that he makes a regular business of stopping people passing with the same story, they being a lazy, shiftless lot. Reaching Cabbage Willows at 1 P. M., we determined to press on. Then came the hardest bit of all. Here the snow had drifted to a great depth; all had to walk, one man tramping a path for the dogs, which fell into single file, the leader being almost hidden in the snow. The second man and I walked by the sled, holding it up, and often helping to push it when the dogs stuck fast.

We reached Black Bear Point at six o'clock and hastened to get tent fixed, wood cut, etc., before dark. We used our cotton tent and the stove here; the wood was rather green, and it took a long time to get the stove to burn and the food to thaw. The night and next morning were passed as before, only that we got up about 3 A. M., and made an early start. It still kept cold with a strong wind in our faces, so that, but for a short walk, I kept down under the blankets. About 9 A. M. we stopped to disentangle the dogs for the last time, and the leader was stripped of her harness and robed in a set gay with ribbons and colored wools, in which to arrive at the place. Directly after this we rounded a point and saw Rupert House a few miles off and knew that they would at once see us. But it was a tedious two hours before we arrived. Rupert House is prettily situated on a high bank of the river, much higher than anything we have round flat Moose Fort. I forgot to say that all the morning and part of the day before we had in sight, far to the north, Sherrick's Mount, a really high hill, and the only hill to be seen for many days' journey round Moose. A gang of men and boys came down the bank and gave the dogs a help up it, so that we arrived in style, on the run, with a great team, human and canine, to receive a most hearty greeting from Mr. M., in charge of the post. On a journey like this toilet exercises are of the most meager kind, and undressing is not practicable; so the first thing to do was to get out of my deerskin coat, which was always shedding its hairs over everything, including my food, and then to have a good wash and thorough change. I cannot now tell of my pleasant stay at Rupert House, visiting everybody, whites and Indians, holding services in the church, and enjoying the rest and the visit generally, but must pass on to my return, which I must dismiss with a few lines. The weather was fine while I was at Rupert House, and a high wind blowing all the time, so we expected the snow to be well packed and make the return journey easier. I had the Rev. E. R., native missionary, and his man with me this time as my crew, and they were naturally not as expert at camping arrangements as the men I had before. Also instead of eleven good dogs I had only eight second-rate; so I did not expect to make such good time. The route was the same as that by which we came, but the division of it different. We started at 7 A. M., and managed to reach Cabbage Willows before dusk. Here is a fixed tent which we used instead of our cotton one. It was a mistake, for it needed more wood, which we had to cut, was very cold, and was

the worst for smoke so far. However, we managed somehow. My present crew were early risers, or we should not have reached home as soon as we did. They had the fire going by two o'clock, and I was up by three; but they were so slow over their preparations that it was after six when we started. I was up each morning by three at the latest, but we only once got off before six; yet I was afraid to lie on, lest they should do the same, and we should be later still.

The second day we only reached East Point; the third, by starting earlier and traveling later, we passed Bigstone without stopping and camped at Natatishe Point. Somehow on the second day I sprained the sinews of my right hand, which swelled very much and became very painful and continued so all the journey. At Natatishe we used our markee and camped very luxuriously on top of a hard snowdrift four feet deep. The fourth day we started early and hoped to reach Moose before noon. But traveling was hard and dogs tired, and we had a tedious time. I tramped a good bit of the way. So we struggled along, getting our dogs into a run here and there, where the snow was not deep, past Pilgrims, the tail of our island, the servants' houses, the factory, along the ox-track, and then a scramble up the bank and through the gap in the fence into our field at the side of the house and so at home just as the Indian children were going into afternoon school at two o'clock. Thus ended my first dog trip. Some fun, some discomfort at least, toes frostbitten, nose and cheeks peeled from the sun and frost, well tanned, and with a fresh stock of health and appetite.

THE GROTTO OF LA BALME.

ALTHOUGH it is annually visited by about 4,000 tourists, most of whom come from Lyons, the Grotto of La Balme, of which we reproduce herewith a few photographic views sent us by M. Boissonnas, the well known artist photographer, does not as yet possess all the reputation that it merits. It is situated in the department of the Isère, at about four miles from the station of Lagnieu and in the immediate vicinity of the pretty little village of La Balme, where one easily finds for hire the change of clothing, lamps and guides that are

FIG. 2.—BACK OF THE LAKE GALLERY.

necessary for visiting it without danger. The grotto, which is hollowed out in a low Jurassic chain, is spacious, easy of access and remarkably dry in all its galleries, save at the epochs in which its lake overflows as a consequence of prolonged rains. It was, of old, a place to which religious pilgrimages were made, and at present contains enough natural curiosities to attract even those whose æsthetic or scientific sense is alone developed. We shall speak of it from this view point solely.

The entrance of the grotto is immense, "one of the grandest known," as M. Martel asserts in his book entitled "Les Abîmes." It is 100 ft. in height and 68 in width. Unfortunately, its aspect is marred by a chapel dedicated to the Virgin, the stairway of which intersects this vast opening transversely and diminishes the artistic effect of it. Back of the chapel, the vault of the grotto is about 50 ft. higher still, so that the visitor finds himself in an immense chamber (the grand nave), decorated with calcareous concretions, whence he can enter the three main passageways, each of which presents an ensemble of peculiar characters. The one to the left, which is quite narrow at its origin, leads to Mandrin's Labyrinth, so called because the notorious brigand of that name took refuge therein at various times and even established there, it is said, a workshop for the manufacture of counterfeit money.

Several tortuous galleries, connected with each other and intersected by cavities in the form of chambers, justify the name of labyrinth given it in the vicinity.

The central gallery, which is wider than the preceding, and is no less uneven, affords a passage for the water which proceeds from an overflow of the lake, and which flows in a torrent over the irregular bottom, in which are hollowed out huge pot holes, multiform basins and fissures wherein the water accumulates, and along the edge of which it is prudent to walk slowly in order to avoid disagreeable duckings.

Quite near the entrance are situated the Grotto of Diamonds, in which hundreds of stalactites sparkle in the light of Bengal fires, and the Basin Amphitheater, wherein there is a succession of superposed bowls which empty their contents one into another and, at the time of high water, form superb cascades. The lake, which occupies the back of this gallery, results from the union of the waters that have infiltered from the summit of the mountain and perhaps also from other and unknown sources.

Bourrit, its first explorer, in the last century, unhesitatingly plunged into it, and, pushing before him as he swam a float upon which candles were fixed, prolonged his excursion to a point at which the low ceiling presented a barrier to his further progress. Such prowess, which has become legendary, would be perfectly superfluous to-day, since a small boat permits the traveler to traverse the lake from one end to the other, and to admire the limpidity of its water and the curious conformation of the ceiling that surmounts it. Such a trip is impressive and cannot be too highly recommended.

As for the passageway to the right, that rises quite rapidly through rocks that have fallen as far as to the Monk's Chamber, one of the most spacious of the entire grotto. This chamber is a wonder. It is strewed with concretions of the most diverse shapes, and upon its floor there rests a huge stalagmite, 10 ft. in height, the

FIG. 1.—THE MONK'S CHAMBER IN THE GALLERY OF BATS.

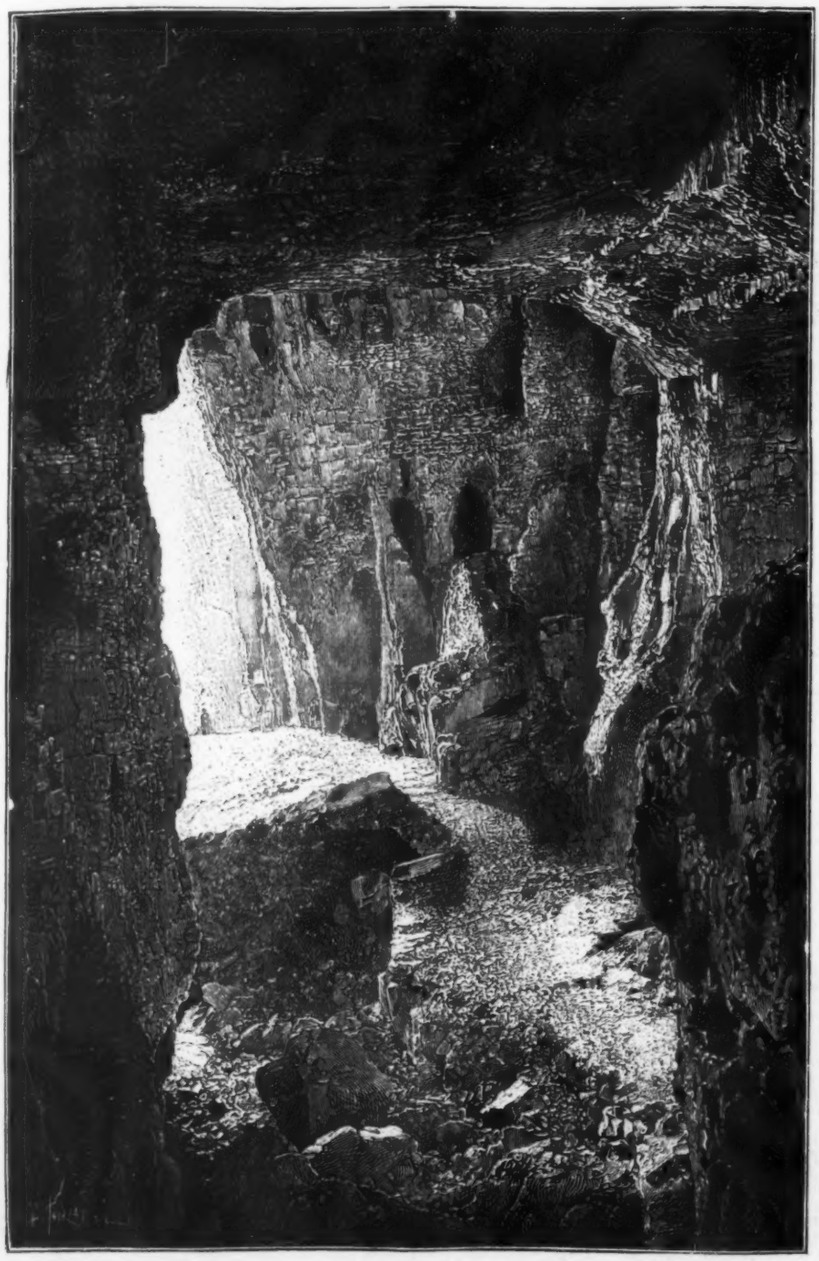


FIG. 3.—VIEW OF THE ENTRANCE OF THE GROTTO OF LA BALME.

form of which somewhat recalls that of a monk, and which is surrounded by other and similar mamelons that have been continuously enlarged by the falling of water, drop by drop, from the vault. From the reproductions of the photographs that we give may be seen the effect produced in this chamber by the play of the light from a powerful magnesium lamp, the rays of which penetrate to the most distant corners. At a few yards further along is found the great fountain, which is formed of an assemblage of basins in which water is in constant circulation and in the center of which stands a magnificent column formed of the union of a stalactite with a stalagmite measuring nearly 5 ft. in diameter.

In retracing our steps in order to reach the great nave, the starting point of these main galleries, we may visit a strange collection of tortuous excavations communicating with each other by narrow fissures. This is the labyrinth of Francis I, in the center of which there is a sort of natural saloon in which the king had a breakfast served at the time of his visit to the grotto.

We have no intention of describing in detail this remarkable cavern, which ought to be known to all speleologists, and to which M. Martel devotes a simple note in his classical work. The concretions that project from its walls have, in places, forms that recall certain organic structures (a beehive, a recumbent lion, a weeping willow, a toadstool, a swallow's nest, etc.), and the conformation of the pot holes, basins and ladders furnishes valuable indications as to the manner in which the grotto was fashioned. Let us be content to add that it requires at least three hours to explore it, and that M. E. Chantre, the learned archæologist of Lyons, has found therein vestiges of human industry, although at the present time it is inhabited only by bats and spiders.—La Nature.

HIBISCUS MANIHOT—FLOWERS SULPHUR-YELLOW, DEEP PURPLE EYE.

HIBISCUS MANIHOT.

EITHER this is a very variable plant, or several species are confused with it. The plant shown by Mr. Fulford, gardener, Moor Hall, Cookham, at Drill Hall, on September 7, 1897, and certificated by the Royal Horticultural Society, differed widely from the plant grown in the temperate house at Kew under this name. Nor is the Kew plant annual, the example under notice being about ten years old. It is cut down early in spring, and by the autumn it makes shoots 6 feet or so high, as thick as a man's finger, and it develops terminal and axillary racemes of flowers in September, being finely in flower now. The largest leaves have petioles 18 inches long, a pedately-lobed blade 18 inches across, the lobes irregularly notched or toothed. Both petiole and blade are [thinly] clothed with soft, very fine hairs. In habit and leaves the plant resembles a vigorous castor oil plant, save that it is of a uniformly dark green color. The flowers are fully 6 inches across, their color being clear sulphur yellow, with a maroon eye-like blotch at the base. The peduncle is 2¼ inches long; the calyx lobes, of which there are four, are over an inch long, by three-quarters of an inch broad at the base. The flowers last only a day or so, but they are borne in large numbers and in quick succession. For a large greenhouse this plant is worth attention. It is ornamental even when not in flower. It thrives better when planted in a border than when grown in a pot. —W. W.

[We believe that this is a very variable plant, and it is possible that some might consider more than one species included under the same name. That is not our view, nor has the inspection of the plant growing in the temperate house shaken our conclusion. The species seems distributed throughout the tropics of the Old World, but whence it originated is not clear. It is said to have been introduced from China, but the species is not enumerated in Forbes' and Hemsley's enumeration of Chinese plants. In the monograph of Malvaceæ, contributed to the Flora of British India by the present writer, it is not recognized as a wild Indian plant (see vol. i, 1875, p. 341). It is not mentioned in Roxburg's Flora Indica, nor in the Flora of Tropical Africa, nor in Mr. Baker's Flora of Mauritius, nor in Grisebach's Flora of the West Indies. On the contrary, it is included as a native plant in Franchet and Savatier's Enum. Plant. Japon. (1875), i, p. 64, and in the Flora of Queensland (Bentham Flora Aust., i, 209). Linnæus, of course, could not have known of this locality. Probably a search through some of the pre-Linnæan books might afford some information, and also give the explanation of the name Manihot, also applied to a Euphorbiaceous genus. Evidently there are some interesting historical details to be unearthed when time and opportunity permit. In the meantime, we can all admire the loveliness of the flower, and although it is of no use for cutting, few things confer greater beauty on the warm greenhouse. We hope Mr. Watson will contrive to fertilize the flower, and secure perfect seed for botanical, as well as for cultural, purposes. It has been cultivated in this country, according to The Botanical Magazine, since 1712, at which period it was sent to the Royal Society as one of the fifty specimens then required to be delivered annually to that Society by the Society of Apothecaries.—ED.]—The Gardeners' Chronicle.

THE CAPRICES OF ORCHIDS.

THE family of plants known as orchids present many anomalies puzzling to botanists. Most of them cannot seed unless some insect or bird assists in effecting fertilization. As a consequence of having the work done through agents, it generally goes undone. Of every thousand of orchid flowers, a very small portion ever perfect seed. But even this seems to have been anticipated, for when a seed vessel does mature, the seeds are as the sands of the sea shore in number, and they are as small and as light as dust; though only one capsule in a large forest should mature, the whole forest area would be stocked full of plants did the seeds grow. But here again comes in a sort of contradiction, for the seeds seem to grow but rarely.

In our own country it has been noted that one of the slipperworts (Cypripedium acaule) usually produces a few seed vessels that mature early. Yet only about the same number of plants are found from year to year as were originally observed in the location. The seeds are widely distributed, but do not grow. The skillful horticulturist, however, makes the seed grow very easily at his bidding.

With a little practice he can get every one to grow as easily as beans. They require, he finds, a very nice combination of conditions to germinate—conditions that are rarely found in a state of nature. The curious question arises, Why should Nature make such complex arrangements with such small results? But here again there seems to be a foreknowledge that these intricate arrangements may fail, and a provision is made for defense by giving them a high power of endurance. None of them are annuals, and they are so constructed that neither an excess of heat nor moisture endangers their existence. They will stay for months dormant under long continued heat and drouth, and push forth at once in all the glory of their showy flowers and luxuriant leaves as soon as a few warm showers come. But the inconsistency of their characters is one of their most striking marvels.

In some parts of the world, especially in Australia, a plant that has long borne flowers of a certain genus and species will, of a sudden, exhibit flowers and foliage of what had hitherto been regarded by botanists as of a totally different genus, and it seems like a stroke of the magic art to have these many different structures proceed from the same individual. In the same line, the hybridist enters the field with his orchid wonders. He finds that what science has told him are distinct genera will cross fertilize, and the product be a race of orchids for which distinct generic names have to be coined. What is more remarkable is that these hybrids, from these distinct genera, are as abundantly fertile as their parents, and the hybrid characters are produced and reproduced by the progeny of the hybrid parent just as perfectly as a normal species fertilized by its own pollen. In fact, no orchid grower despairs of producing hybrids between any species or genera. He will tell us that success or non-success is merely a matter of experiment. Continually the most surprising combinations are announced. One of the most recent successes is between two genera comparatively common in our greenhouses and conservatories. One is the purple butterfly orchid (Zygopetalum Mackayi), the other the tooth-tongued orchid (Odontoglossum crispum). The contrary behavior of orchids in these various stages of life is proving a great strain on botanical science. It seems impossible to arrange them into genera and species under any system that will prove of stability. The fecundation of orchids by artificial means is so easy that many amateur growers are finding in it a new source of floral gratification. The little beak-like cap at the apex of the column of stamens and pistils is pushed off, and the pollen masses exposed. These are placed on the stigma, and the work is done. The interest is in the form of the capsules that follow. In the case above cited, the purple butterfly orchid, a pear-like seed vessel, as large as the upper segment of a large thumb, follows, and not only this, but the petals of the orchid get a renewed lease of life by the operation. Instead of falling a few days after expansion, they erect themselves, and give some interest for a month or more.—Independent.

THE BEGINNINGS OF AMERICAN ASTRONOMY.*

IT is impossible, even in the briefest sketch, not to emphasize the debt of American science and learning to the intelligent interest and patronage of our early presidents—Washington, John Adams, Jefferson, Madison, Monroe, John Quincy Adams. The powerful impetus given by them and through them has shaped the liberal policy of our governments, national and State, toward education and toward science. Sir Lyon Playfair, in his address to the British Association for the Advancement of Science (1885), has recognized this influence in the truest and most graceful way. He said: "In the United Kingdom we are just beginning to understand the wisdom of Washington's farewell address to his countrymen (1796) when he said: 'Promote, as an object of primary importance, institutions for the increase and diffusion of knowledge; in proportion as the structure of a government gives force to public opinion, it is essential that public opinion should be enlightened.'"

Until the Revolution (1776) American science was but English science transplanted, and it looked to the Royal Society of London as its censor and patron. Winthrop, Franklin and Rittenhouse were, more or less, English astronomers. Franklin was the sturdiest American of the three. As early as 1743 he suggested the formation of the American Philosophical Society, of Philadelphia. John Adams founded the American Academy of Arts and Sciences in Boston in 1780. These two societies, together with Harvard College (founded in 1636), Yale College (1701), the University of Virginia (founded by Jefferson in 1825) and the United States Military Academy at West Point (1801), were the chief foci from which the light of learning spread. Other colleges were formed or forming all over the Eastern and Middle States during the early years of the century.

The leading school of pure science was the Military Academy at West Point, and it continued to hold this place until the civil war of 1861. From its corps of professors and students it gave two chiefs to the United States Coast Survey; and the army, particularly the corps of engineers, provided many observers to that scientific establishment, besides furnishing a large number of professors and teachers of science to the colleges of the country. The observatory of the academy was founded by Bartlett, in 1841, and much work was done there, only a small part of which is published. The Coast Survey was a school of practice for army officers, and their experience was utilized in numerous boundary surveys during the period 1830-50. Col. J. D. Graham, for example, was astronomer of the survey of the boundary between Texas and the United States in 1839-40; commissioner of the northeast boundary survey, 1840-43; astronomer of the northwest boundary survey, 1843-47; of the boundary between the United States and Canada, 1848-50; of the survey of the boundary between Pennsylvania and Virginia, 1849-50; of the boundary survey between Mexico and the United States, 1850-51. The names of Bonneville, Talcott, Cram, Emory and other army officers are familiar in this connection, and their work was generally of a high order. It was in such service that Talcott invented or reinvented the zenith telescope, now universally employed for all delicate determinations of latitude. The mechanical tact of Americans has served astronomy well. The sextant was invented by Thomas Godfray, of Philadelphia, in 1730, a year before Hadley brought forward his proposal for such an instrument.† The chronograph of the Bonds, the zenith

* From Science

† In 1700 Sir Isaac Newton sent drawings and descriptions of a reflecting sextant to Halley for his advice. At Halley's death these were found among his papers. Hadley's device (1731) was undoubtedly derived from Newton's MSS. The Royal Society, of London, granted £2 0 to Godfray for his invention, which his brother, Capt. Godfray, had previously put into practical use in the West Indies.

telescope of Talcott and the break circuit chronometer of Winlock are universally used to-day. The diffraction gratings of Rutherfurd were the best to be had in the world till they were replaced by those of Rowland. The use of a telescope as a collimator was first proposed by Rittenhouse. The pioneer opticians of the United States were Holcomb (1826), Fitz (1846 or earlier), Clark (1845), Spencer (1851). Only the Clarks have a world-wide reputation. Würdemann, instrument maker to the United States Coast Survey (1834), had a decided influence on observers and instrument makers throughout the United States, as he introduced extreme German methods and models among us, where extreme English methods had previously prevailed. The system of rectangular land surveys which proved to be so convenient for the public lands east of the Rocky Mountains was devised and executed by Mansfield, a graduate of the Military Academy.

The list of army officers who became distinguished in civil life as professors in the colleges of the country is a very long one. Courtenay (class of 1821 at West Point) was professor of mathematics at the University of Pennsylvania, 1834-36, at the University of Virginia, 1842-43, and was the author of admirable text books. Norton (class of 1831) became professor at New Haven, and wrote a very useful text book of astronomy in 1839; and the list could be much extended. The excellent training in mathematics at West Point (chiefly in French methods) early made itself felt throughout the whole country. The mathematical text books of Peirce, of Harvard, and of Chauvenet, of the Naval Academy, brought the latest learning of Europe to American students. Mitchell (class of 1829 at West Point) was the only graduate who became a professional astronomer (1842-61). His direct service to practical observing astronomy is small, but his lectures (1842-48), the conduct of the Cincinnati observatory (1845-59), and his publication of the Sidereal Messenger (1846-48), together with his popular books, excited an intense and widespread public interest in the science, and indirectly led to the foundation of many observatories. He was early concerned in the matter of using the electric current for longitude determinations, and his apparatus was only displaced because of the superior excellence of the chronograph devised by the Bonds. His work was done under immense disadvantages, in a new community (Ohio), but the endowment of astronomical research in America owes a large debt to his energy and efforts.

The Navy and the United States Naval Academy (founded by Bancroft in 1845, at the suggestion of Chauvenet) were very active in astronomical work. Chauvenet (Yale College, 1840) published a text book of trigonometry, in 1850, which had an important share in directing attention to rigid, elegant and general methods of research. His astronomy (1863) is a handbook for all students. Walker, Gilliss, Coffin, Hubbard, Ferguson, Keith, Yarnall, Winlock, Maury, Wilkes, were all connected with the navy, more or less intimately. Walker's career was especially brilliant; he graduated at Harvard College in 1825, and established the observatory of the Philadelphia High School in 1840. He was the leading spirit in the United States Naval Observatory at Washington (1845-47) and introduced modern methods into its practice at the beginning. From the observatory he went to the coast survey to take charge of its longitude operations, and he continued to direct and expand this department until his death, in 1853. To him, more than to any single person, is due the idea of the telegraphic method ("the American method") of determining differences of longitude. His assistant in this work was Gould, who succeeded to the charge of it in 1853. His researches extended to the field of mathematical astronomy also, and his theory of the planet Neptune (then newly discovered) marks an important step forward. His investigations and those of Peirce were conducted in concert and attracted general and deserved attention.

The exploring expedition of Wilkes required corresponding observations to be made in America, and during the period 1838-42 William Bond, at Dorchester, and Lieutenant Gilliss, at Washington, maintained such a series with infinite assiduity and with success. The results of Gilliss' astronomical expedition to the southern hemisphere (Chile, 1849-52) were most creditable to him and to the navy, though his immediate object—the determination of the solar parallax—was not attained.

The Coast Survey began its work in 1817 under Hassler, a professor from West Point, who impressed upon the establishment a thoroughly scientific direction. Bache, his successor (a grandson of Benjamin Franklin), was a graduate of West Point in the class of 1825, and took charge of the survey in 1843. He is the true father of the institution, and gave it the practical efficiency and high standard which characterized its work. He called around him the flower of the army and navy, and was ably seconded by the permanent corps of civilian assistants—Walker, Saxton, Gould, Dean, Blunt, Pourtales, Boutelle, Hilgard, Schott, Goodfellow, Cutts, Davidson and others.

Silliman's (& Dana's) American Journal of Science had been founded at New Haven in 1818, and served as a medium of communication among scientific men. A great step forward was made in the establishment of the Astronomical Journal by Dr. Gould on his return from Europe at the close of 1849.* Silliman's Journal was chiefly concerned with the non-mathematical sciences; though it has always contained valuable papers on mathematics, astronomy and physics, especially from the observers of Yale College—Olmsted, Herrick, Bradley, Norton, Newton, Lyman and others. In Mason, who died in 1840 at the age of 21, the country lost a practical astronomer of the highest promise.† Gould's Journal was an organ devoted to a special science. It not only gave a convenient means of prompt publication, but it immediately quickened research and helped to enforce standards already established and to form new ones. The Astronomical Notices of Bruennow (1858-62) might have been an exceedingly useful journal with an editor who was willing to give more attention to details, but, in spite of Bruennow's charming personality and great ability, it had comparatively little influence on the progress of the science.

* The Astronomische Nachrichten had been founded in Altona, by Schumacher, in 1821.

† See International Review, vol. x, p. 585.

The translation of the Mécanique Céleste of Laplace by Nathaniel Bowditch, the supercargo of a Boston ship (1815-17), marks the beginning of an independent mathematical school in America. The first volume of the translation appeared in 1829; at that time there were not more than two or three persons in the country who could read it critically. The works of the great mathematicians and astronomers of France and Germany — Laplace, Lagrange, Legendre, Olbers, Gauss, W. Struve, Bessel—were almost entirely unknown.

Bowditch's translation of the Mécanique Céleste, and, still more, his extended commentary, brought this monumental work to the attention of students and within their grasp. His Practical Navigator* contained the latest and best methods for determining the position of a ship at sea, expressed in simple rules. American navigators had no superiors in the first half of the century. Nantucket whalers covered the Pacific, Salem ships swarmed in the Indies, and the clipper ships made passages round the Horn to San Francisco which are a wonder to-day. Part of their success is due to the bold enterprise of their captains (who were said to carry deckloads of studding sail booms to replace those carried away!) but an important part depended on their skill as observers with the sextant. One of the sister ships to the one of which Bowditch was supercargo was visited at Genoa by a European astronomer of note (Baron de Zach), who found that the latest methods of working lunar distances to determine the longitude were known to all on board, sailors as well as officers. His bewilderment reached its climax when the navigator called the negro cook from the galley and bade him expound the methods of determining the longitude to the distinguished visitor.

On Bowditch's own ship there was "a crew of twelve men, everyone of whom could take and work a lunar observation as well, for all practical purposes, as Sir Isaac Newton himself." Such crews were only to be found on American ships in the palmy days of democracy. All were cousins or neighbors, and each had a "venture" in the voyage. But these anecdotes may serve as illustrations of the intellectual awakening which came about as soon as our young country was relieved from the pressure of the two wars of 1776 and 1812. An early visitor, Baron Hyde de Neuville (1805), felt "an unknown something in the air," "a new wind blowing." This new spirit, born of freedom, entered first into practical life, as was but natural; science next felt its impulse, and, last of all, literature was born. Emerson hailed it (in 1837) "as the sign of an indestructible instinct." "Perhaps the time is already come," he says, "when the sluggard intellect of this country will look from under its iron lids and fill the postponed expectation of the world with something better than the exertions of mechanical skill. Our day of dependence, our long apprenticeship to the learning of other lands, draws to a close. The millions that around us are rushing into life cannot always be fed with the sere remains of foreign harvests."

Benjamin Peirce a graduate of Harvard in the class 1829, had been concerned with the translation of the Mécanique Céleste, and was early familiar with the best mathematical thought of Europe. He became professor in Harvard College in 1833, and after the death of Bowditch, in 1838, he was easily the first mathematical astronomer in the country. His instruction was precisely fitted to develop superior intelligences, and this was his prime usefulness. Just such a man was needed at that time. Besides his theoretical researches on the orbits of the planets (specially Uranus and Neptune) and of the moon, his study of the theory of perturbations, and his works on pure mathematics and mechanics, he concerned himself with questions of practical astronomy, although the observations upon which he depended were the work of others. He was the consulting astronomer of the American Ephemeris and Nautical Almanac from its foundation in 1849, and its plans were shaped by him to an important degree. His relative, Lieutenant Davis, United States Navy (the translator of Gauss' Theoria Motus Corporum Cœlestium, 1857), was placed in charge of the Ephemeris, and the members of its staff—Runkle, Ferrel, Wright, Newcomb, Winlock and others—most effectively spread its exact methods by example and precept. Professor Peirce undertook the calculations relating to the sun, Mars and Uranus in the early volumes of the Ephemeris. As a compliment to her sex, Miss Maria Mitchell was charged with those of Venus; Mercury was computed by Winlock, Jupiter by Kendall, Saturn by Downes, Neptune by Sears Walker.

The Smithsonian Institution was founded in 1846, and Joseph Henry was called from Princeton College to direct it. There never was a wiser choice. His term of service (1846-78) was so long that his ideals became firmly fixed within the establishment and were impressed upon his contemporaries and upon a host of younger men. The interests of astronomy were served by the encouragement of original research through subsidies and otherwise, by the purchase of instruments for scientific expeditions, by the free exchange of scientific books between America and Europe, and by the publication of the results of recondite investigations. It is by these and like services that the Institution is known and valued among the wide community of scientific men throughout the world.

But this enumeration of specific benefits does not convey an adequate idea of the immense influence exercised by the Institution upon the scientific ideals of the country. It was of the first importance that the beginnings of independent investigation among Americans should be directed toward right ends and by high and unselfish aims. In the formation of a scientific and, as it were, a moral standard a few names will ever be remembered among us; and no one will stand higher than that of Henry. His wise, broad and generous policy and his high personal ideals were of immense service to his colleagues and to the country.

The establishment of a national observatory in Washington was proposed by John Quincy Adams in 1825; but it was not until 1844 that the United States Naval Observatory was built by Lieut. Gilliss, of the Navy, from plans which he had prepared. By what seems to have been an injustice Gilliss was not appointed to be its first director.* This place fell to Lieut. M. F. Maury. Gilliss had been on detached service for some years, and a rigid construction of rules required that he should be sent to sea, and not remain to launch the institution which he had built and equipped.

The first corps of observers at Washington (1845) contained men of first class ability—Walker, Hubbard, Coffin. Gilliss' work as astronomer to Wilkes Exploring Expedition (1838-42), at his little observatory on Capitol Hill, had shown him to be one of the best observers, as well as one of the most assiduous. His study and experience in planning and building the Naval Observatory had broadened his mind. To the men just named, with Peirce, Gould and Chauvenet, and to their coadjutors and pupils, we owe the introduction of the methods of Gauss, Bessel and Struve into the United States, and it is for this reason that American astronomy is the child of German, and not of English science.

The most natural evolution might seem to have been for Americans to follow the English practice of Maskelyne and Pond. But the break caused by the war of independence, by the war of 1812, and by the years necessary for our youthful governments to consolidate (1776-1836) allowed our young men of science to make a perfectly unbiased choice of masters. The elder Bond (William Cranch Bond, born 1789, director of Harvard College Observatory, 1840-59) was one of the older school and received his impetus from British sources during a visit to England in 1815.

In estimating the place of the elder Bond among scientific men, it is necessary to take into account the circumstances which surrounded him. He was born in the first year of the French revolution (1789); he was absolutely self-taught; practically no astronomical work was done in America before 1838. When Admiral Wilkes was seeking for coadjutors to prosecute observations in the United States during the absence of his exploring expedition, he was indeed fortunate in finding two such men as Bond and Gilliss. Their assiduity was beyond praise, and it led each of them to important duties. Bond became the founder and director of the observatory of Harvard College, while Gilliss is the father of the United States Naval Observatory at Washington, as well as of that of Santiago de Chile, the oldest observatory in South America. Cambridge, though the seat of the most ancient university in America, was but a village in 1839. The college could afford no salary to Bond, but only the distinction of a title, "Astronomical Observer to the University," and the occupancy of the Dana house, in which his first observatory was established. His work there, as elsewhere, was well and faithfully done, and it led the college authorities to employ him as the astronomer of the splendid observatory which was opened for work in 1847. At that time the two largest telescopes in the world were those of the Imperial Observatory of Russia (Pulkova) and its companion at Cambridge. Each of these instruments has a long and honorable history. Their work has been very different. Who shall say that one has surpassed the other? We owe to Bond and his son the discovery of an eighth satellite to Saturn, of the dusky ring to that planet, the introduction of stellar photography, the invention of the chronograph, by which the electric current is employed in the registry of observations, the conduct of several chronometric expeditions between Liverpool and Boston to determine the transatlantic longitude, and a host of minor discoveries and observations.

Gilliss visited France for study in 1835, before he took up his duties at Washington. The text books of Bond and Gilliss were the astronomies of Vince (1797-1808) and of Pearson (1824-29). The younger Bond (George Phillips Bond, born 1825, Harvard College 1844, director of the Harvard College Observatory 1859-65) and his contemporaries, on the other hand, were firmly grounded in the German methods, then, as now, the most philosophical and thorough.

It was not until 1850, or later, that it was indispensable for an American astronomer to read the German language and to make use of the memoirs of Bessel, Encke and Struve, and the text books of Sawitsch and Brünnow.† This general acquaintance with the German language and methods came nearly a generation later in England. The traditions of Piazzi and Oriani came to America with the Jesuit Fathers of Georgetown College (1844), of whom Secchi and Sestini are the best known.

The dates of the foundation of a few observatories of the United States may be set down here. Those utilized for the observation of the transit of Venus in 1769 were temporary stations merely. The first college observatory was that of Chapel Hill, North Carolina (1831); Williams College followed (1836); Hudson Observatory (Ohio) (1838); the Philadelphia High School (1840); the Dana House Observatory, of Harvard College (1840); West Point (1841); the United States Naval Observatory (1844); the Georgetown College Observatory (1844); the Cincinnati Observatory (1845); the new observatory of Harvard College (1846); the private observatory of Dr. Lewis M. Rutherfurd in New York City (1848); the observatory at Ann Arbor (1854); the Dudley Observatory at Albany (1856); and that of Hamilton College (1856).

These dates and the summary history just given will serve to indicate the situation of astronomy in the United States during the first half of the present century. A little attention to the dates will enable the reader to place an individual or an institution on its proper background. It must constantly be kept in mind that the whole country was very young and that public interest in astronomical matters was neither educated nor very general. The data here set down will have a distinct value as a contribution to the history of astronomy in America. The developments of later years have been so amazing that we forget that the first working observatories were founded so late as 1845.

American science is scarcely more than half a century old. The day will soon come—it is now here—when we shall look back with wonder and gratitude to ask who were the men who laid the wide and deep foundations which already maintain so noble an edifice.

EDWARD S. HOLDEN.

Mt. Hamilton, Cal., April, 1897.

* First edition, 1802. Sumner's method in navigation (1843)—a very original and valuable contribution from a Boston sea captain—and Maury's Wind and Current Charts, begun in 1844, are two other notable contributions from a young country to an art as old as commerce.

* He was, however, director during the years 1861-65.

† Dr. Bowditch learned to read German in 1818, at the age of 45.

ENGINEERING NOTES.

The fastest and longest run of a train hauled by an oil-fired engine is (says The Engineer) that of the Cromer express, on the Great Eastern Railway. Leaving Liverpool Street terminus at 1:30 P. M., this train arrives at Cromer—138 miles' distance—at 4:25 P. M., with but one stop at North Walsham, eight miles from Cromer, where it is due at 4:10. This gives a run of 130 miles in 160 minutes, or an average rate of 48·75 miles per hour. The train is regularly worked by the single driver express engine of Mr. Holland's standard design, and fired on his oil fuel system, and no similar fast train in the world is worked with such ease to the firemen.

Haulage ropes are generally made of steel wire, in Germany mostly of plow steel. According to a recent article in the Zeitschrift des Vereins Deutscher Ingenieure, ropes of aloe fiber may compete with steel, even for deep shafts. The aloe fiber is stronger and more elastic, but less flexible than manila hemp; its chief advantage is that it becomes stronger in damp places. The ropes have to be tarred, but, in spite of this circumstance, the corresponding lengths of rope which would break by virtue of their own weight are 12,000 for aloe and 12,500 for steel. In Belgian mines haulage by means of aloe ropes is quite common; great lengths are made with decreasing thickness.

General Wilson, chief of engineers of the army, has been making an examination of the report of the Mississippi River Commission and has brought to light some very interesting facts connected with the flood of last spring. It is shown that the flood of the Mississippi was the highest of which there is any record. The total length of the levees on both sides of the river was 1,377 miles, and there were in all thirty-eight breaks by the flood, aggregating eight and seven-tenths miles. An interesting feature of the breakages is that none of the levees built by the United States government were broken, but the breaks occurred in those portions which had been built by States or municipalities or private persons. The Mississippi River floods will form an important part of the annual report of General Wilson, which is now in the course of preparation.

River dredging for gold is a new development in the mining industry which has attained a good deal of importance during the last two or three years, and dredges are now working successfully in the United States, in Georgia, Montana, Idaho and California. They have been especially successful in New Zealand. The amount of gold won in this manner in 1897 will be considerable, and next year it is likely to be still greater, the success of the dredges now employed being well established, and there being undoubtedly a good many places where they can be put to work to advantage. The idea is by no means a new one. As long ago as 1885 a company was organized to exploit the bed of the Atrato River, in Colombia, in this manner, but owing to defective apparatus, or perhaps to some extent to mismanagement, the undertaking failed, although there is reason to believe that the bottom of that river is rich in gold.

It sometimes happens in a machine shop that a piece of work is spoiled, or a tool broken, through not being stopped at a definite point in its progress. A simple piece of apparatus has just been devised which is applicable to any machine tool, and which stops the machine when a certain amount of work has been done. It consists of an electrical relay, which, when a current passes through it, releases a weighted lever, which shifts the belt and so stops the machine. At the same time an electric bell commences ringing to call the attendant's attention, the contact pointer is insulated from the machine bed, and the instrument is so placed that when the feed gear has moved the tool over the distance required it makes contact with either the slide rest or other moving part of the machine. A battery of a few Leclanche cells is sufficient to work several machines. This might prove a most useful labor saver, but as its object is to enable one man to look after two or three machines, its introduction is certain to be opposed by the workmen.

Engineering skill is likely to play an important part at Vladivostok, a prominent Russian port and the terminus of the Siberian Railway, but where for over four months the port is blocked up with ice, rendering shipping traffic impossible. For many years the Russian authorities have been endeavoring to overcome these natural difficulties, and some time ago ice breaking ships were introduced to break open the ice, an operation, however, which has proved practically useless. It is now reported that "a certain engineer" has proposed a plan for reclaiming the narrowest part of the Tartar strait between Saghalien and the Russian mainland. The theory of such an undertaking is that, if this is done, the cold current which enters the Japan Sea from the Arctic via Behring Strait will be checked, and the passage of the warmer tide, coming from the south through the Tshuma Strait, will make the water on the coast of Japan as warm as Vladivostok, and the latter will be warm all the year round. The expectation is entertained that this remarkable engineering work will be entered upon after the completion of the Siberian Railway.

In a new system of sinking shafts through quicksands and water-bearing strata by means of a freezing process, invented by Louis Koch, says The Engineering and Mining Journal, gaseous carbonic acid, ammonia, or a mixture of dioxide of sulphur, is circulated in specially constructed tubes, whereby a degree of cold of from 40° to 60° C. is generated and communicated to the ground. The freezing pipes are sunk through the bedrock, where the shaft is to be constructed, and this can be done in any direction and in any required number. Then they are connected with the condenser and the compressor, and a conduit is constructed for returning the expanded gases to the machine. The compressed gases become volatile on leaving the compressor in the connecting pipe, and take their course, directly or indirectly, as vaporous gas through apertures into the freezing apparatus, in order to enter into two separated conduits and thence into the various divisions of the apparatus and there to generate cold. The generation of cold thus takes place simultaneously and uniformly throughout the whole length of the combined apparatus,

ELECTRICAL NOTES.

The trains on the Bavarian railroads carry telephone receivers and transmitters, by which trainmen can at any time communicate with the nearest station.—Electrotechnische Rundschau.

In 1837, when it was proposed to erect a telegraph between St. Petersburg and Peterhoff, Schilling suggested as an alternative to a cable that the wires should be carried on posts, but one of the members of the commission said that "Wires in the air are truly ridiculous." Sixty years afterward the British authorities think so too.

The Italian Mediterranean Railway Company have, it is said, made a contract with the Electrical Company of North Italy to apply their electric brakes to both the passenger and goods trains between the stations of Bardonneche and Modane on the Mont Cenis line. Should the trial be satisfactory, the whole of the line between Modane and Turin will be similarly equipped.

Workmen are now engaged in completing the installation of the electric light at the Houses of Parliament. Electricity reigns supreme in the dining rooms, lobbies, and corridors, and its use is gradually extending to the committee rooms. On the Peers' side, the Royal Gallery is being treated in a similar manner, and the dining room and grand committee room will be attended to in due time. Throughout the entire building there are no fewer than 5,000 lights.

The total length of the world's telegraph system has now reached 4,908,921 miles, exclusive of 180,440 miles of submarine cables. Of this Europe has 1,764,790 miles; Asia, 310,685 miles; Africa, 99,419 miles; Australia, 217,479 miles; and America, 2,516,548 miles. United States Consul Germain, who sends these figures to the State Department from Zurich, says they show that, notwithstanding the steady increase in the building of telegraph lines all over Europe, America leads the world and has almost double the European mileage.

A New York contemporary gives a description of a hoist magnet worked in connection with an electric traveling crane. The double-pole magnets in use at the plate mill of the Illinois Steel Company can handle with safety five tons, and only take about four ampères with a 250 volt current. After the magnet has been lowered on to a pile of plates, and several plates have been taken out together, the operator breaks the current for a moment, and one or two plates drop off at each break. It is said that enough residual magnetism remains in the plates next to the magnet to hold them until the current is again switched on. A concentric pole magnet has been constructed for handling hot plates and ingots, and there has been no difficulty in handling a 6,000 lb. or 8,000 lb. ingot at a low red heat.

The cable that is being laid between London and Birmingham for telegraphic purposes is making slow progress, and possibly the end of the century will arrive before it is in full use. It is not, it appears, to act as a substitute for the overhead wires, but is merely to augment the service and provide a means of avoiding the effects of storms. The new cable is being laid at a depth of about 2½ ft., and is described as of a kind which has not been used hitherto for telegraphic purposes, though it has been adopted to a great extent for telephonic services. Inclosed in a metal tube about 2 in. in diameter are 76 copper wires, and the novelty in the construction is that the wires are insulated from each other and from the sheathing by paper. Air passes between the wires and their wrappings, and assists in their insulation. It is thought that if the cable can be kept free from water, there is no likelihood that the paper will perish, and means to secure this freedom from damp are being taken while the cable is being laid.

A new railway signal is being tried on the Delaware, Lackawanna & Western Railroad, at Kingsland, N. J., U. S. A. The signal is peculiar, says The Electrician, in that the semaphore is pivoted at the center and revolves as an indication of safety. When it remains immovable it indicates danger. The semaphore arm is supported on a bracket fixed to the semaphore post and is operated by an electric motor. Placed on a spindle above the box containing the motor is a red signal lamp, which is obscured twice by each revolution of the blade, and the resultant flashes serve as a night safety signal. The continuous red light corresponds with the stationary arm day signal, and indicates danger at night. When the blade assumes the danger position it stands out horizontally, as do the ordinary semaphore signals. Two cells of storage battery are used for the operation of the motor and the track circuits. The cells are placed within a proper receptacle at the base of the semaphore post, and in the present instance have proved very satisfactory in operation. They are charged by a dynamo located in the railroad shops near by.

Most of the machinery in the Swedish iron ore mines is worked by electric power, and the installation at Grangesberg is the first long distance transmission of electric power in Sweden, says the Iron and Coal Trade Review, the distance from the Hellsjon Lake to Grangesberg being some 7½ miles. At Hellsjon, where the turbines are placed, there are three dynamos, one of 150 horse power and two of 100 horse power each, direct coupled to a turbine making 600 revolutions. The three phase current, of 150 volts pressure, is subsequently transformed into one of 5,500 volts. In addition to the above three generators there are two more 100 horse power dynamos, each in connection with a turbine; the one supplies a single phase current for lighting purposes, while the other can give either a three or a single phase current and is held in reserve. There are altogether twelve motors, varying in capacity from 45 horse power downward. Dynamite is used for blasting purposes, and is manufactured on the spot; the annual production is about 80 tons, of which half is used in the Grangesberg mines. The largest mine is the "Skarningen." Hitherto the ore has been put direct on to the trucks, but it is now broken at a lower level than that of the railway. The ore is separated from the rock in the mine; an electric ore separator is being installed. The bore holes are now larger (22 millimeters) and deeper than used to be the case, whereby less dynamite is required. The work is carried on night and day, electric light being installed.

MISCELLANEOUS NOTES.

A splendid deposit of copper has been discovered on the west coast of Newfoundland, says the Times. Analysis shows that the ore contains 83 per cent. of copper. It is located on the treaty shore, but can be worked through the new railway.

M. Michelin proposes to insert a clause in the next French budget for the withdrawal of copper coins of ten and five centimes from circulation and replacing them with nickel coins of twenty, ten, and five centimes. If the proposal is adopted, a total of 70,000,000 francs will be struck off. To avoid confusion with the silver currency the nickel coins will be pierced in the center and will have a smooth edge. They will be composed of 25 per cent. nickel and 75 per cent. copper.

The growth of the naphtha industry in Russia has been a rapid one. In 1870 the output of naphtha for the whole of Russia did not exceed 1,750,000 poods; in 1882 the yield was already more than 50,000,000 poods; ten years later, about 300,000,000 poods; and in 1894, 316,000,000 poods, of which 309,000,000 were obtained in the Baku government. Not all this immense quantity of naphtha is consumed by Russia alone, which has increased the export of naphtha and its products from 1,000,000 poods in 1881 to 60,000,000 in 1893.

More than 500,000 sewing machines are made in this country annually, which is 90 per cent. of the production of the world. Nearly 100,000 persons in one way and another make their living in this country out of sewing machines. In no branch of manufactures has a greater revolution been wrought by the sewing machine than in boots and shoes. In 1861 the first machine for sewing on soles was put into operation and a royalty of two cents on shoes exacted. By the aid of machines 350,000,000 pairs of shoes had been made up to 1877 in the United States, and probably an equal or greater amount in Europe.

A new use for peanuts is developing as the peanut butter industry becomes better understood. This product of the peanut answers in the place of ordinary butter for table use and is said to be excellent for shortening purposes, and for gravies, sauces, etc. In point of purity it is superior to the best dairy butter. It is well designed for the use of vegetarians who strenuously object to anything animal. There is already a considerable demand for this butter substitute, and it is very probable there will be an enlarged market for the nuts. At present the product of the United States is about 500,000 bags annually and that of the world is 600,000,000 pounds.—West Coast Trade.

Aluminum has replaced wood in parts of machinery, and it is also being used in place of rubber. The Waldo Foundry, of Bridgeport, Conn., has recently cast several thousand aluminum mouthpieces for graphophones. These were formerly made of rubber, but it is found that aluminum gives far better results, as it is more resonant. A very useful article made by the Waldo Foundry is chemical crucible tongs of aluminum. These are light and handy, and are not eaten by acids. Chemical tongs of other metals turn black, but a pair of aluminum tongs, used in the foundry laboratory for several years, are as bright as when first made.

Yankee ingenuity has produced a soapstone boot drier which should prove extremely useful in winter time. It consists of a block of soapstone, 8 by 2¼ by 1⅜ inches in size, attached to a wire bail for convenience in handling. There are grooves on the bottom running at right angles with each other, and holes which pass entirely through the block vertically to facilitate the escape of moisture. This commodity is designed largely for use in connection with rubber boots and shoes, leather boots, etc., and is especially recommended by the manufacturers for campers, lumbermen and others, who, by heating the stone and placing it in position after the footwear is removed, exhaust the moisture without injury to the fabric.—Philadelphia Record.

The Explosives Department of the Home Office has recently had under consideration the question of the restrictions to be applied to the manufacture and keeping of acetylene gas, and has conducted various experiments with the object of gaining information on this matter. The results show conclusively, Engineering reports, that acetylene gas when under a pressure of something less than two atmospheres is violently explosive; whereas at a pressure of less than 1½ atmospheres it appears to be reasonably free from liability to explosion, provided it is not admixed with oxygen or atmospheric air. For commercial and practical purposes it is considered sufficient to allow a pressure of 20 in. of water above that of the atmosphere (roughly about 1$\frac{1}{30}$ atmospheres), and it is accordingly proposed to draw the safety line at this point, and to declare acetylene when subject to a higher pressure to be an "explosive" within the meaning of the Explosives Act, 1875. In France and Germany, the authorities have fixed the limit of danger at 1½ and 1·1 atmospheres respectively, and have imposed prohibitions or restrictions on the keeping or manufacture of the gas when it is at a higher pressure.

Not so many improvements have characterized the process of coating cloth with rubber as have marked the progress of some other features in the application of that material in the arts. The chief solvents used in dissolving the rubber for coating purposes are naphtha, shale spirit, and benzol, these being mixed with purified solid paraffin by grinding together. Solubility is promoted by grinding or working; the raw or washed rubber is less soluble than that masticated or ground, and well ground rubber is more easily taken up than that which has been less worked. The washed rubber is for waterproofing, says the Boston Commercial Bulletin. The next operation is to grind the rubber and pigments together, run it out into a thin sheet and digest in naphtha, with a slight stirring as it is added, and the finishing is performed by dough mixers. The treatment of fabric which has to be done by spreading with the rubber consists in passing it through a pair of calenders, in order to press down knots and give a smooth and even surface, after which it is passed over a steam chest to expel moisture, it being now ready to receive the first coat. A little oxide of zinc or a little naphtha, which is retained by the rubber and which it gives up very slowly, is a drying which proves quite useful and prevents blistering in curing.

THE TRANS-SIBERIAN RAILWAY.

Begun in the month of May, 1891, the work of constructing the great Trans-Siberian Railway has been pursued with what may be called feverish haste. Such haste, although excessive, is nevertheless preferable to too great dilatoriness. After deciding to undertake the work, the Russian government immediately got at it, and it is certain that the Asiatic transcontinental will be completed within the time originally fixed. On the day upon which the last rail has been bolted, the new railway, although inadequate for an extensive traffic, and not as yet possessing all of its commercial utility, will nevertheless possess all of its political importance. The two extremities of the Czar's immense empire will be closely connected, a route to China will have been created, and Russia, mistress of such route, will improve it at her leisure.

At the end of last year the trains starting from Tcheliabinsk were already running as far as to Krasnoiarsk. This city, of rich and flourishing aspect, is destined for considerable development. An English company, which has recently established entrepots here, is bringing in by ocean and river large quantities of products of English manufacture, principally linen and cotton goods.

At the end of January the section from Krasnoiarsk to Kainsk was open to the running of trains. From Kainsk to Kloutchi, too, the road is finished, but trains are running thereon only irregularly.

The section of the line that is to run around Lake Baikal from Irkoutsk to Mysovsk is for the moment entirely neglected. The government has decided to postpone the construction of the railway in this rough and mountainous region, the cost of which, it is calculated, would be $60,000 per mile. The project is to employ large ferry boats of the American type, powerful enough to break the ice in winter, for carrying the trains from one shore of Lake Baikal to the other. These boats, gaging 4,000 tons, will be provided with two screws driven by a 3,750 horse power steam engine. They will be capable of carrying a train of twenty-five cars at a speed of about fifteen miles an hour, and will consequently take three hours to cross the lake.

In order to reach Lake Baikal from Irkoutsk, one ascends the river Angara. In winter this river is frozen over at Irkoutsk, as is also the lake for its entire extent. Nevertheless, starting from the Baikal, for a length of from six to nine miles, the river never freezes. This curious fact must be attributed both to the swiftness of the current at this place and to the relatively high temperature of the deep water of the lake, which is fed by a large number of warm springs.

The work on the railway is being resumed at Verkhne Oudinsk through Transbaikalia. As far as to Tchita it is not far advanced, but from Tchita to Nertchinsk it is being pushed with the greatest activity. This important section will be opened to exploitation during the course of next year.

The line of Manchooria, designed to replace the north-south. This section, which is called the Oussouri Railway, has just been completed, but it is not probable that the exploitation of the line can be begun for several months yet.

In leaving Khabarovka, the direction line follows for 270 miles the right bank of the Oussouri, the left bank of which belongs to Chinese Manchooria. The valley of the Oussouri is narrow. This river, all along its course, receives numerous torrents and a few affluents of a certain importance, separated from each other by high offshoots of the Sikhota chain of mountains. No part of the Trans-Siberian necessitated so many bridges and cuttings and so much filling in. It has been possible, however, to avoid the construction of tunnels. In this valley, moreover, an enormous amount of rain falls every year. Inundations are frequent, and wherever the railway approaches the bed of the Oussouri important sustaining walls have had to be built in order to protect it.

Three of the bridges over the affluents of the Oussouri are 840 feet in length. These are those of the rivers Khor, Bikin and Ima. Like the rails, the bridge iron came from the Russian works of the Oural and Donetz. As the superstructure of these bridges could not be of a single span, it rests upon two stone piers. The establishment of a masonry pier in the bed of a Siberian river, such as the Ima, which is immeasurably swollen at the time of the melting of the snow or as a consequence of torrential rains, and which is covered for four months with thick ice, required special processes. It was necessary to take advantage of the period of congelation of the water. The materials were easily carried upon the ice, by means of sleighs. Around the site of the pier foundations, upon the frozen surface, was constructed a wooden house for the workmen, and it was in the interior of this, protected from the cold, snow and storms, that they did their work. When the period for the ice to break arrived, they removed their improvised shop, but the pier remained ready for the reception of the long metallic superstructure.

CRIMINALS WORKING UPON THE TRANS-SIBERIAN RAILWAY UNDER THE SUPERVISION OF SOLDIERS.

Kloutchi is now the terminus of the Trans-Siberian of the west, and we have just learned by telegraph that Khabarovka has, for some days, been the terminus of the Trans-Siberian of the east, or the Oussouri Railway, the head of the line of which is Vladivostok. From Kloutchi to the Oussouri, that is to say, from the center of Russian Asia to the shore region of the Pacific, nearly a hundred thousand laborers are busily engaged upon the colossal work. Some of these, such as the blacksmiths, carpenters, etc., are free workmen, while others, who are employed upon rough work, such as digging trenches, filling in, carrying wood and iron, etc., are criminals who are closely watched by soldiers. On the west and east sides the rails are being rapidly laid and the sections constructed simultaneously at a large number of points are being connected. Strietensk and Khabarovka, which were connected during the summer by steamboat service upon the river and its affluent, the Chilka, will be the two provisional extremities of the line.

Between Kloutchi and Irkoutsk the work is far enough advanced to allow it to be seen that in January, 1898, travelers starting from Moscow or St. Petersburg will reach Lake Baikal without leaving the cars. Along the postal road from Irkoutsk to Krasnoiarsk travel innumerable caravans, some bringing into Russia bales of tea that have come from China through Kiakhta, and others carrying to Irkoutsk European merchandise from the entire region of the Baikal. Such animation is a good omen for the traffic of the railway.

Strietensk-Khabarovka section, will make a connection between the cities of Nertchinsk and Strietensk.

Strietensk, upon the Chilka, and Khabarovka, upon the Amoor, would be connected by an admirable water way if the Siberian winters were not so severe. Unfortunately, the Amoor and its affluent the Chilka are free from ice only from May to September. Navigation, therefore, lasts but four months, or five at the most; but during this very short period it is very active.

Upon the Amoor, at a nearly equal distance from Strietensk and Khabarovka, at the mouth of the river Zeia, which comes from the country of gold mines, there has been built an important and growing city. This is Blagovestchensk, which is both a mining center and a fluviatile port of the first rank. The complete melting of the snow and breaking up of the ice in the river take place here toward the middle of May. It is then that the city is busiest. Numerous boats daily arrive and start and ascend or descend the Amoor. The majority are now occupied in the carriage of rails and other materials designed for the railway. The Transsiberian, until it is finished, will thus absorb the entire activity of Siberia.

One of the boats that descend the river takes us to Khabarovka, at the confluence of the Amoor and Oussouri. Khabarovka, which is a military city, is the residence of the governor general of the three provinces of Transbaikalia, Amoor and Littoral. Thence to Vladivostok, the railway leaves its general direction from west to east, in order to take a direction exactly

Upon the river Ima is situated the little village of Iman, where but yesterday stopped the trains coming from Vladivostok, and which thus acquired a certain temporary importance. It was here that was unloaded the merchandise for transshipment upon boats that afterward reached the Amoor in descending the Oussouri. The boats that did the carrying were those that had brought either to Iman or to the different points situated between Khabarovka and Iman the materials taken aboard at Nikolaievsk, a seaport at the mouth of the Amoor and designed for the construction or exploitation of the railway.

From Iman station to that of Vladivostok the line (upon which trains have been running since 1895) is 265 miles in length. The locomotives were, almost all of them, purchased in the United States. As for the cars, they came for the most part from the great Russo-Baltic works of Riga. A few of them were purchased at Vladivostok.

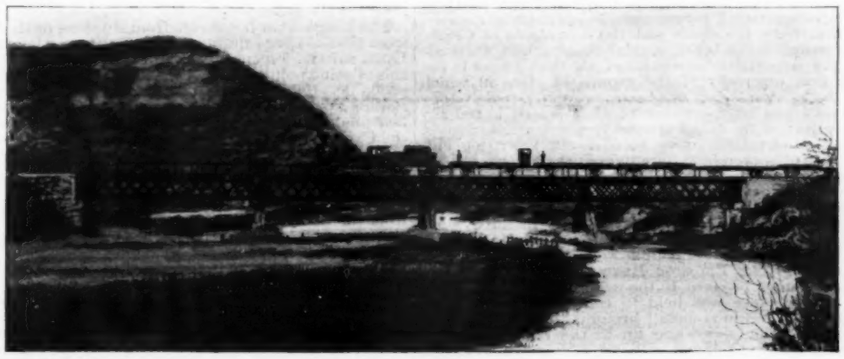
At 37 miles from Iman the line crosses the Oussouri

upon a new bridge. To the west it leaves Lake Khanka, a simple permanent inundation called by the Chinese Khan-Khai, or "Mediterranean." Then the road follows the valley of the river Lefou, which falls into this lake not far from the station of Nikolskoie, which is destined to become the head of the line of section. The track is single and the most distant stations are 33 miles apart. Three trains a day are run in each direction.

"Vladivostok! all out!" It would not be commonplace to hear this cry on the evening of the tenth day passed in a car of this monster Oriental Express that

BRIDGE OVER THE OUSSOURI, 288 MILES FROM VLADIVOSTOK.

the Manchooria Railway. After leaving this station, which is 83 miles distant from Vladivostok, the line enters the valley of the river Souifoun. The inundations of this little affluent of the Sea of Japan are far more dangerous than those of the Oussouri. The line along the side of the mountain had been insufficiently studied, and the exploitation had hardly been begun when the engineers perceived that an entire section, constructed upon loamy earth, at about 50 miles from Vladivostok, was slowly descending into the Souifoun. Such sliding could only be arrested at the cost of important works that have been but recently finished. Could this valley, so beset with obstacles, be avoided? Competent men think that it could, and adversely criticise the direction line that was adopted between



BRIDGE OF THE RIVER LEFOU, AT 100 MILES FROM VLADIVOSTOK.

Vladivostok and Nikolskoie, in that it causes the railway to run a greater danger than that of the inundations from above and slidings from below, since twelve miles before reaching Vladivostok the line runs along the shore of the bay of Peter the Great, and in case of war it would be easy for the ships of an enemy to bombard the track, and thus cut off the communication of Vladivostok with the valleys of the Oussouri and the Amoor. Such considerations, it is said are capable of determining the abandonment of the present line and the selection of a new one nearer to the east.

The general rules laid down for the entire Transsiberian have naturally been applied to this eastern the Trans-Siberian train will be. But it is only in France that travelers are thus notified as to what they have to do by the indistinct yells of men appointed for the purpose.

Vladivostok, the name of which signifies "Ruler of the East," and which has been developing for the last two or three years with a rapidity seen only in American towns, was founded in 1861 at the extremity of a peninsula that divides the bay of Peter the Great into two parts. This peninsula is continued by a group of islands, the principal of which is Kozakovitch. The strait that separates this island from terra firma has received the name of the Eastern Bosphorus. It is in the center of this strait that has been built the city of Vladivostok surrounded with verdant hills, which themselves surround one of the finest natural ports in the world, called by the Russians the Golden Horn.

Vladivostok is not yet, but may hope to become the Constantinople of the Far East. Its climate, without resembling that of Marseilles, which is in the same parallel, is not so severe as might be supposed. Like the port of Odessa, the Golden Horn is blocked by ice for only a month and a half or two months in the year.

Two Russian ports upon the Pacific now divide between them the importations of European merchandise—those of Vladivostok and Nikolaievesk. The latter, although closed for six months of the year, has for a long time been able to benefit by its situation at the mouth of the river Amoor, which carries the imported products into the interior. Nevertheless, in recent years, the supremacy of Vladivostok has become indisputable, and the completion of the Transsiberian and opening of the Transmanchoorian will definitely consecrate it.

The vessels that the Golden Horn receives bring to Siberia linen and cotton goods from England, the same goods, but in ordinary quantities, along with tobacco, sugar and alcohol, from Russia, glass and table utensils from Belgium, flour, machines and farming implements from the United States, agricultural products from Corea, fruit and rice from Japan, etc. The exportations from Vladivostok, which up to the present are not of much importance, consist of furs and especially various products derived from the whale and seal fishing.

The commerce of the city is concentrated in the hands of foreigners in the proportion of 75 per cent. Of the business about 30 per cent. is done by Germans, about 13 per cent. by English and Germans, 12 per cent. by Chinese and 5 per cent. by Americans.—L'Illustration.

THE DETERRENT INFLUENCE OF MODERN ARMS.*

By Gen. O. O. HOWARD, U. S. Army (retired).

IT is now a common thought, regardless of the spurs of religion, which probably are as active to-day as ever in history, and one independent of the blessings attendant upon peace makers and peace seekers everywhere, that the modern improvements in arms, arrangement and methods of war will have, nay, have already had, a strong deterrent effect against war upon all the civilized peoples and governments of the world.

It is said by one of our scientific thinkers that all anger thought and fear thought come from mental germs of abnormal growth, and that they can be and should be torn up by the roots and cast away. I am of the mind, judging from passing events, that the day has not yet come for this; and that fear and anger will remain for some time to be quite generally predicable of human souls and of nations. Certainly while fear continues, battle and war will excite it, as they always have done; and more and more will be the apprehension as the probability of persisting in a conflict increases. The soldier cannot help seeing and knowing the facts of extreme danger; and even if he be brave enough to take desperate chances or march to certain death, still his government or the people back of it will be unwilling to make the sure sacrifice of his life.

The rifle now used in our regular army, named the United States magazine rifle, was adopted in 1892. The weight of the weapon is nine pounds, having a caliber of 0·31 of an inch. Its sight is graduated for a range of 1,900 yards, but it can be fired easily 3,000 yards. Its bullet has a weight of 220 grains. Its flight is swift and almost noiseless. The smokeless powder renders the place from which it starts impossible of discovery by observing enemies. When it strikes the hardest wood its effect is several times greater than that of any rifle which we used in the late war. Think of those experiments with this rifle at our proving grounds, where block after block of pine lumber, each an inch in thickness, was added till there was an obstruction of four feet. Those little steel-headed projectiles, sent from a gun a thousand yards away, easily passed through the blocks without injury to themselves. Three feet of oak fared no better, while even iron plate three-quarters of an inch in thickness suffered a like perforation. I remember the grim effect upon my young heart more than forty years ago when I first saw a riddled target, and was asked by a companion how I would like to stand that racket. This modern firing is considerably worse and done at once. By observation it is found that men's arteries are severed as if cut by the lancet and the bones are comminuted as if dried and pounded in a mortar, and yet the bullets themselves receive little or no injury. Ours is a magazine gun and supplies five cartridges at a time. This is the rifle with which a soldier may easily hold his aim and send twenty bullets against the target or an adversary each minute. Should he desire to fire without aiming, the number of shots may be doubled. His only limit in destructiveness will be found in the size of the ammunition load which he can carry.

Should an enemy in close formation come near a company, say of not to exceed twenty men, the members of that company could easily dispose of, by death and wounds, from eight to ten thousand men in less than an hour's time. It is not likely that just this arrangement could ever be made for twenty marksmen, but I offer this object lesson to indicate the effects of this modern

* From The Independent.

PANORAMIC VIEW OF THE CITY AND PORT OF VLADIVOSTOK.

arm. With an intrenched regiment having this United States magazine rifle, a regiment of a thousand men like the Third Maine, the Second Massachusetts, the Second Vermont or the Ninth Indiana of our war, whose prowess in action I so often observed or knew of, a skillful colonel would be able to hold his ground against any successive rushes which ten thousand men could make. With plenty of ammunition, a star fort, having its approaches properly earth covered and its parapet guarded by such rifles, could not be taken by assault. Had Lee's troops been thus armed at Fredericksburg, every man of ours who passed beyond the line of the city houses and approached the Marye Heights would have fallen, and Burnside could not with his army have recrossed the Rappahannock.

I notice that the Hotchkiss rifle, a field cannon, has been much experimented with at our proving grounds, and is in our service in both army and navy. Its trials varied from 100 to 4,000 yards. The weight of the powder in a charge is about two pounds, and the length of the cartridge complete is 19 inches; the shell is steel. In firing for rapidity and with accuracy at 1,000 yards, ten shots were fired with but one miss. The ten rounds were fired in 2 minutes and 36¼ seconds. At one mile range were fired ten shots, again with but one miss, all in 1 minute and 33½ seconds. This gun easily sends its projectile a distance of five miles.

What is called the six pounder Maxim-Nordenfelt gun, or some slight modification of it, is the one about which so many inquiries are made in the journals of the day. We have had this gun under trial since 1894, firing it with rapidity and accuracy through different ranges. The provers began with one sighting shot, then delivered ten shots without a miss. The deviations from the middle of the target were inconsiderable. This was accomplished in 2 minutes and 37½ seconds for a one mile range. For a three mile range three trials were allowed for the sighting, then ten shots quickly followed at the target and all hit. The caliber of this cannon is 2·244 inches. The estimated time is 20 rounds per minute, or 65 rounds in three minutes. The Germans called the field pieces to which I refer, after making their own improvements upon them, "the model of '73 and '78," the caliber being 88 millimeters (3·3 inches). During 1890, the Germans succeeded still further with these field guns and their carriages, making progress. Their new gun is now denominated the model of '91. They have secured elasticity of metal and increased tenacity, thus eliminating, as far as possible, dangers from breakage and bursting, which, of course, always had immediate deadly effects upon their own artillerymen, and could not help causing widespread apprehension and terror among them. And again, in their carriages and ammunition wagons made for these guns they have secured greater lightness, and are now in these respects considerably ahead of the French.

The smokeless powder will aid much both the French and the Germans in gaining for themselves a prospective morale over a foe not so well furnished—a foe having only other kinds of powder. It is interesting to observe the efforts made by German officers to have exploding shells give some plain signs of where they strike. I am reminded of our own efforts in the war to read the enemy's signal code. The German artillerists, using the smokeless powder in their cannon, "put 300 balls into the shell, and in the interstices of these balls they introduce a powder whose composition is a secret;" that is to say, thus far secret. The French can analyze, and so can our chemical experts. That new explosive mixture is colored. The impact and explosion of these shells can, now, from the flash, be easily detected by a field glass at a distance of three miles. We shall soon be abreast of other armies in such things as these colored flashes, enabling the battery officers to measure length of range and discover far-off points of danger and obstacles to be overcome. No one can exaggerate the effect of a battery thus equipped, after the range shall be ascertained—its effect against infantry, cavalry or inferior artillery. Troops in open ground without cover, so withstood, must give way or be practically annihilated.

THE WORSHIP OF METEORITES.*

HERE is a small fragment of iron that has a curious history. It is a portion of a mass of meteoric iron found upon a brick altar in one of the Ohio mounds. Along with it were various objects—a serpent cut out of mica—several terra cotta figurines—two remarkable dishes carved from stone into the form of animals; pearls, shells, copper ornaments and nearly three hundred ankle bones of deer and elk. There were but one or two fragments of other bones, and one animal furnished but two of these ankle bones; hence they must have been selected for some special, important reason. The figurines had been apparently broken for some purpose, and the whole collection had suffered in the fire not a little. In a like altar of another mound of the same group were found nearly two bushels of like objects.

It must have been in some ceremony of a religious, possibly one of a funereal, character that the mound builders collected here on the altar their ornaments and other valuables, and after burning them buried the charred débris in the huge earthen mound that was built over them and the altar.

What would we not give if this fragment could be endowed with the power of repeating to us its experience—chapters in the history of that people? But nearly all that we can say is that it was found among objects held by them in peculiar esteem, and used by them in some serious, probably religious ceremony.

There was formerly, and so far as I know there is still, in the collection of meteorites in Munich, a stone that weighs about a pound. It fell in 1853 in the region north of Zanzibar, on the East African coast, and was seen and picked up by some shepherd boys. The German missionaries tried to buy it, but the neighboring Wanikas, because it fell from heaven, took it to be a god. They secured possession of it, anointed it with oil, clothed it with apparel, ornamented it with pearls, and built for it a kind of temple to give it proper divine honors. The agents of the missionaries were not allowed even to see the stone, far less could they purchase the Wanika's tutelar deity. Neither entreaties, nor arguments, nor offers of the missionaries, nor of the officials were of any avail. But when three years later the wild nomad tribes of the Masai came down upon the Wanikas, burned their village, and killed large numbers of them, the Wanikas thought very differently of the stone's protecting power. In fact, they lost all respect for it. A famine having meanwhile arisen, the elders of the tribe were quite ready to exchange their palladium for the silver dollars of the missionaries.

Among the Buddha legends is one of two merchants who offered food to the Buddha, which was accepted, and in consequence of their request for some memorial of him the Buddha gave them a hair and fragments of his nails, and told them that hereafter a stone should fall from heaven near the place where they lived, and that they should erect a pagoda and worship these relics as though they were Buddha himself.

The nations of India have always been specially superstitious about stones fallen from the skies. In 1620 an aerolite fell near Jullunder, and the king sent for a man well known for the excellent sword blades that he made, and ordered him to work the lump into a sword, a dagger and a knife. The mass, however, would not stand the hammer, but crumbled in pieces. By mixture with iron of the earth the required weapons were made.

In 1867 a shower of stones fell, some forty in number, at Saonlod. The terrified inhabitants of the village, seeing in them the instruments of vengeance of an offended deity, set about gathering all they could find, and having pounded them into pieces, they scattered them to the winds.

In 1870 a meteorite fell at Nidigullam, and the Hindoos at once carried it to their temple and worshiped it. The same has been repeated in India on the occasion of several stonefalls in the present century. One native ruler refused to allow a stone to be carried across his territory for fear of the injury that might come to his people or his lands.

Two Japanese meteorites, formerly the property of a daimio family, were long kept and handed down as heirlooms, being in the care of the priests in one of the family temples. They were among the family offerings made to Skokujo on her festival days. They were connected with her worship by the belief that they had fallen from the shores of the Silver River, Heavenly River, or Milky Way, after they had been used by her as weights with which to steady her loom. One of these stones was presented by its late owner to the British Museum, and it is in its collection of meteorites.

There is a curious institution among the Chinese that has existed, according to Biot, from a time more than one thousand years before Christ. The Chinese attributed to different groups of stars a direct influence upon different parts of the empire. Some of these groups correspond, for example, to the imperial palaces, to the rivers, the roads and the mountains of China. By reason of this belief, regular observations are made by the imperial astronomers of all that passes in the heavens, especially of the groups of stars in which comets and meteors originate, or across which they travel. The interpretation of what is seen in the sky forms part of the duties of these very important officials. These observations have been carefully written out, and are preserved in the archives of the empire. Upon the ending of a dynasty, by change of name or otherwise, these comet and meteor records have been published as a special chapter of the chronicles of the dynasty. The existing dynasty began in 1647, since which date the records are, therefore, unpublished.

In 1492 a stone of 300 pounds weight fell at Ensisheim, in Alsace. The Emperor Maximilian, then at Basel, had the stone brought to the neighboring castle, and a council of state was held to consider what message from heaven the stonefall brought to them. As a result, the stone was hung up in the church with an appropriate legend, and with strictest command that it should ever remain there intact. It was held to be an omen of import in the contest then in progress with France and in the contest impending with the Turks. Nineteen years later a shower of stones fell near Crema, east of Milan. The Pope was at war with the French, and the stones fell into the French territory. Before the year had passed the French, after a long possession of Lombardy and serious threatening of the States of the Church, were forced to retire from Italy. At this time Raphael was painting for an altar piece his magnificent Madonia di Foligno, now in the Vatican. Beneath the rainbow in the picture, indicating divine reconciliation, Raphael painted also this Crema fireball, apparently to set forth divine aid and deliverance.

I have thus rapidly gone over some selected facts, showing how the mound builders, the wild Africans, the Hindoos, the Japanese, the Chinese, the modern Europeans, have been ready to revere these mysterious bodies that come from the skies. But it is in the Greek and Latin literature that we have reason to expect the more numerous and full accounts, both legendary and historic, of this reverence and worship.

It is now, I believe, admitted by the best scholars that both in Greece and in Italy there was a period, earlier than the age of images, when the objects worshiped were not wrought by hand. Men worshiped trees and caves, groves and mountains, and also unwrought stones. Even after men began to make their objects of worship, these were in many cases mere hewn stones, not images. The earlier Greek term ἄγαλμα, an object of worship, stands apart from the latter term εἰκών, image.

What would be more natural in that age to the affrighted witnesses of the most magnificent of spectacles, the fall of a meteorite, than for them to regard the object which had come out of a clear sky, with terrific noise and fire and smoke, as something sent to them by the gods to be revered and worshiped? It was nobler to worship a stone fallen from the sky than one of earthly origin.

The worship of an unwrought stone once established has wonderful vitality. For example, the Greek writers speak of such a worship in their day among the Arabian tribes. When Mohammed, with his intense iconoclasm, came down upon Mecca and took the sacred city, he, either for reasons of policy or from feeling, spared the ancient worship of this black stone. Entering into the sacred inclosure, he approached and saluted it with his staff (where it was built into the corner of the Kaaba), made the sevenfold circuit of the temple court, returned and kissed the stone, and then entered the building and destroyed the 360 idols within it. To-day that stone is the most sacred jewel of Islam. Toward it each devout Moslem is bidden to look five times a day as he prays. It is called the Right Hand of God on Earth. It is reputed to have been a stone of paradise, to have dropped from heaven together with Adam. Or, again, it was given by Gabriel to Abraham to attest his divinity. Or, again, when Abraham was reconstructing the Kaaba, that had been destroyed by the deluge, he sent his son Ishmael for a stone to put in its corner, and Gabriel met Ishmael and gave him this stone. It was originally transparent hyacinth, but became black by reason of being kissed by a sinner. In the day of judgment it will witness in favor of all those who have touched it with sincere hearts, and will be endowed with sight and speech. The color of this stone, according to Burckhardt, is deep reddish brown, approaching to black; it is like basalt, and is supposed by some to be a meteorite.

It is not important for my purpose to separate the history from the myth. Eusebius quotes from an old Phœnician writer, Sanchouniathon, that the goddess Astarte found a stone that fell from the air, that she took it to Tyre, and that they worshiped it there in the sacred shrine. We have reason to question whether that Phœnician writer ever lived. What matters it? The existence of the story in Eusebius' time has to us a significance not greatly unlike that of the existence of the worship itself in the earlier years.

Virgil describes a detonating meteor in such terms that I feel reasonably sure that either he had seen and heard, or else he had had direct conversations with others who had seen and heard a splendid example of these meteors. The passage is in the second book of the Æneid. The city of Troy was captured and was burning. All was in confusion. The family of Æneas was gathered ready for flight, but Anchises would not go. An omen, lambent flames on the head of his grandson, began only to shake his purpose to perish with his country. He prayed for more positive guidance. It is Æneas who describes the scene:

"Hardly had the old man spoken when across the darkness a star ran down from the sky carrying a brilliant light torch. We saw it go sweeping along above the roof of the house. It lighted up the streets, and disappeared in the woods on Mount Ida. A long train, a line of light, remained across the sky, and all around the place was a sulphurous smell. A heavy sound of thunder came from the left. Overcome now, my father raised his hands to heaven, addressed the gods and worshiped the sacred star. 'Now, now,' he cried, 'no longer delay.'"

This story is, of course, all legendary, but Virgil's description of the scene is true to life as conceived by pagan Rome in his day.

The images that fell down from Jupiter, or that fell from the skies, are often spoken of by Greek and by Latin writers. I mention three or four cases only where this allusion points to a meteoric origin as possible or probable. The earliest representative of Venus at old Paphos, on the island of Cyprus, was one of these heaven-descended images. It was not the Venus of the Capitol, nor the Venus of Milo, but as described was a rude triangular stone.

Cicero, in the grand closing passage of his oration against Verres, calls upon Ceres, whose statue he says was not made by hands, but was believed to have fallen from the skies. The earliest of the images of Pallas at Athens was said to have had a like origin. Pausanias saw at Delphi a stone of moderate size which they anointed every day, and covered during every festival with new shorn wool. They are of opinion, he adds, respecting this stone, that it was the one given by Cybele to Saturn to swallow as a substitute for the infant Jupiter, which Saturn after swallowing vomited out on the earth.

There is a marvelous story of a peculiar stone in the poem Lithika by the apocryphal Orpheus. Phœbus Apollo gave the stone to the Trojan Helenus, and Helenus used it in soothsaying. It was called Orites, and by some Siderites. It had the faculty of speech, and when Helenus wished to consult it he performed special ablutions and fasts for twenty-one days, then made various sacrifices, bathed the stone in a living fountain, dressed it and carried it in his bosom. The stone now became alive, and to make it speak he would take it in his arms and dandle it, when the stone would begin to cry like a child for the breast. Helenus would now question the stone, and receive its answers. By means of these he was able to foretell the ruin of the Trojan state. Whoever framed that story had, I believe, before him a real stone, and the description is very like that of a meteorite, saying nothing of its having come from Apollo. The Orphic writer says that it was rough, rounded, heavy, black and close grained. Fibers like wrinkles were drawn in circular forms over the whole surface above and below.

Here I show you a stone such as was described—rounded, black, heavy, close grained and having fibers like wrinkles in circular forms over the whole surface above and below.

The name Siderites was at a later date applied to the loadstone, but by this writer the two stones are separately described, and are apparently distinct. If this name was of Greek origin, it seems to be allied to sideros, iron, and this heavy stone, like nearly all meteorites, probably contained iron. If, however, this name came from a Latin source (for it is used both by Greek and by Latin writers), it has affinities with Sidus, a star, and its meteoric character is still more clearly indicated.

One of the most interesting of the stories about images that have fallen from heaven is the basis of that beautiful tragedy of Euripides, "Iphigeneia in Tauris." To many of you the story is familiar, but it will bear repetition.

The goddess Diana detained at Aulis the Grecian fleets by contrary winds, and required the sacrifice of Iphigeneia, the daughter of Agamemnon, before the Greeks could set sail. The father consented; and the daughter, apparently sacrificed, was really rescued by Diana, and borne to the Tauric, or Crimean peninsula on the north shore of the Black Sea. She was then made a priestess in the temple of the goddess. At this shrine the barbaric inhabitants used to sacrifice before an image of Diana, that fell from heaven, all strangers that were shipwrecked upon the coast. The unhappy

* A lecture delivered in New Haven, Conn., by the late Prof. Hubert A. Newton. (Reprinted from the American Journal of Science.)

Iphigeneia, forced to take a leading part in these human sacrifices, laments her sad lot:

"But now a stranger on this strand,
'Gainst which the wiid waves beat,
I hold my dreary, joyless seat,
Far distant from my native land;
Nor nuptial bed is mine, nor child, nor friend.
At Argos now no more I raise
The festal song in Juno's praise;
Nor o'er the loom sweet sounding bend,
As the creative shuttle flies,
Give forms of Titans fierce to rise,
And dreadful with her purple spear
Image Athenian Pallas there.
But on this barbarous shore
'Th' unhappy stranger's fate I moan,
The ruthless altar stained with gore,
His deep and dying groan;
And for each tear that weeps his woes,
From me a tear of pity flows."

Orestes, the brother of Iphigeneia, had avenged upon his mother the murder of his father. For this he was driven by the Furies. While stretched before the shrine of Phœbus he heard the divine voice from the golden tripod, commanding him to speed his way to the wild coast of the Taurians, thence to take by fraud or by fortune the statue of Diana that fell from heaven, and carry it to Attica. Doing this, he should have rest from the Furies.

He was captured, however, along with his friend Pylades, and brought to the altar to be sacrificed. The relationship of the brother and sister became here revealed, and they together fled, carrying with them the image. It was not without a struggle that they reached the shore, but finally,

"On his left arm sustained
Orestes bore his sister through the tide,
Mounted the bark's tall side and on the deck
Safe placed her and Diana's holy image
Which fell from heaven."

Neptune favored the Greeks, Minerva forbade pursuit, and the image was borne to Halae (or as some said to Brauron) in Attica.

Cicero spoke of the Trojan Palladium as something that fell from the sky: quod de coelo delapsum. Other classical writers, notably Ovid, speak of it in similar terms. The story in its various forms points toward a stonefall as its basis. One form of it runs thus:

Pallas and her foster sister Athena were wrestling with each other, when Pallas was accidentally killed. In grief Athena made an image of Pallas and set it up on Olympus. When King Ilus was about building his city on the Trojan plain he prayed for a favorable omen. In response to his prayer Jupiter cast this image down at the feet of the suppliant king. In the new city it was set up in a temple specially erected to contain and protect it. So long as Troy could keep safely this image, the city, it was firmly believed, could not be taken by its foes.

According to one story, the Greeks stole the image before capturing the city. As many cities afterward claimed to possess the treasure as claimed to be the birthplace of Homer. According to the Romans, Æneas carried the Palladium to Italy, and the image was regarded as the most sacred treasure of the Roman state. For centuries even in historic times it was so carefully kept by the Vestal Virgins that the Pontifex Maximus was not allowed to see it.

We naturally have doubts about the nature, or even the existence, of an object so kept out of sight. What it was that the Vestals thus guarded, or whether they had anything to represent the image of Pallas, will probably never be known. But it is far otherwise with another famous object of Roman worship. To the east of the Trojan plain on which the Palladium fell rise the mountains of Phrygia and Galatia. In Pessinus, near the border line of these two countries, and in the caves and woods near Pessinus, the goddess Cybele, the mother of the great gods Jupiter, Neptune and Pluto, was specially worshiped. This worship may not have been more degrading than the worship of many other Asiatic divinities. But it was wretched and unmanly almost beyond our possible conception. It furnished to Catullus the theme for the most celebrated of his poems, one of the strongest pictures in all literature. The Grecian athlete entered her service with joyful music and dancing. Too late he looks back from the Asiatic shore, out of his hopeless degradation, on the nobleness of his former Grecian life. The lion of Cybele drives him in craven fear again into the wild woods to spend his days in the menial servitude. The Roman poet exclaims, "O goddess, great goddess Cybele, goddess queen of Dindymus; far from my house be all thy frenzies; others, others, drive thou frantic!"

At some unknown early time a meteoric stone fell near to Pessinus. It was taken to the shrine of Cybele and there set up and worshiped as her image. This image and its worship very early attained a wide celebrity. About two hundred years before Christ, in the time of the second Punic war, the stone was transported to Rome. The detailed history of the transfer is given by several writers in varied terms. It forms one of Livy's charming stories, it is told in poetic terms by Ovid, it is given as a tradition by Herodian. For every detail of the history I do not ask confiding belief, but the principal event is, I suppose, historically true.

In the year 205 before Christ, Hannibal had, since crossing the Alps, been holding his place in Italy for more than a dozen years, threatening the existence of the Roman state. The fortunes of war were now somewhat adverse to the Carthaginian general. A shower of stones alarmed the Romans. The decemvirs consulted the Sybilline books and there found certain verses which imported that whensoever a foreign enemy shall have carried war into the land of Italy, he may be expelled and conquered if the Idæan mother be brought from Pessinus to Rome. These words were reported to the Senate. Encouraging responses came at the same time from the Pythian oracle at Delphi.

The Senate set about considering how the goddess might be transported to Rome. There was then no alliance with the states of Asia. But King Attalus was on friendly terms with the Romans because they had a common enemy in Philip II of Macedon. The Senate, therefore, selected an imposing embassy from the noblest Romans. A convoy of five quinqueremes was ordered for them that they might make an appearance suited to the grandeur of the Roman people. The embassy landed on their way and made inquiry of the oracle at Delphi, and were informed that "they would attain what they were in search of by means of King Attalus, and that when they should have carried the goddess to Rome they were to take care that whoever was the best man in the city should perform the rite of hospitality to her." The king received them kindly, but refused their request; whereupon an earthquake tremor shook the place and the goddess herself spoke from her shrine, "It is my will. Rome is a worthy place for any god; delay not." The king yielded; a thousand axes hewed down the sacred pines and a thousand hands built the vessel. The completed and painted ship received the stone and bore it to the mouth of the Tiber.

It was the spring of the following year before the ship arrived. Meanwhile new prodigies frightened the people. A brilliant meteor had crossed Italy from east to west, a little south of Rome, and a heavy detonation followed. From this, or from some other meteor, another shower of stones had fallen. In expiation, according to the custom of the country in case of stonefalls, religious exercises during nine days were ordered. The Senate, after careful deliberation, selected one of the Scipios, deciding that he, of all the good men in the city, was the best, and they deputed him to receive the stone. The whole city went out to meet the goddess. Matrons and daughters, senators and knights, the vestals and the common people all joined the throng. But a drought had reduced the water of the Tiber so that the vessel grounded upon the bar. All the efforts of the men pulling upon the ropes failed to move it. A noble matron who had been slandered stepped forward into the water. Dipping her hands three times into the waves and raising them three times to heaven, she besought the goddess to vindicate her good name if she had been unjustly slandered. She laid hold of the rope, and the vessel followed her slightest movement amid the plaudits of the multitude.

Scipio, as he had been ordered by the Senate, waded out into the water, received the stone from the priests, carried it to the land and delivered it to the principal matrons of the city, a band of whom were in waiting to receive it. They, relieving each other in succession and handing it from one set to another, carried it to the gates of the city and thence through the streets to the temple of Victory on the Palatine Hill. Censers were placed at the doors of the houses wherever the procession passed, and incense was burned in them, all praying that the goddess would enter the city with good will and a favorable disposition. The people in crowds carried presents to the temple. A religious feast and an eight days' festival with games were established to be celebrated thereafter each year in the early part of April.

Before another year had passed, Hannibal, after having maintained his army in Italy for fifteen years, was forced to withdraw again to Africa. From the liberal offerings of the people, in gratitude for deliverance, a temple was erected to Cybele, long known as the Temple of the Great Mother of the Gods, so that twelve years after its arrival at Rome the stone was taken from the Temple of Victory and set up in its new home. A silver statue of the goddess was constructed, to which the stone was made to serve in place of a head. Here, in public view, for at least five hundred years that stone was a prominent object of Roman worship. Its physical appearance is described by several writers. It was conical in shape, ending in a point, this shape giving occasion to the name Needle of Cybele. It was brown in color and looked like a piece of lava. Arnobius, a Christian writer just before the accession of Constantine, and over five hundred years from the date of its arrival at Rome, says of the stone:

"If historians speak the truth and insert no false accounts into their records, there was brought from Phrygia, sent by King Attalus, nothing else in fact than a kind of stone, not a large one, one that could be carried in a man's hand without strain, in color tawny and black, having prominent, irregular, angular points, a stone which we all see to-day, having a rough irregular place as the sign of a mouth and having no prominence corresponding to the face of an image." Arnobius goes on to ask whether it was possible that this stone drove the strong enemy Hannibal out of Italy—made him who shook the Roman state unlike himself, a craven and a coward.

Just when this stone disappeared from public view I do not know. In directing the recent excavations on the Palatine Hill, Prof. Lanciani was at first in great hopes of finding it; because it had no intrinsic value to the many spoliators of Rome nor to the former excavators of Roman temples. But the place in which he expected to find it was absolutely empty. At a later date, however, he found in a rare volume an account of excavations made on the Palatine Hill in 1730, in which the private chapel of the Empress was found and explored. In this we perhaps have an account, and, it is to be feared, the last account of a sight of the Cybele stone. The writer says: "I am sorry that no fragment of a statue, or bass relief, or inscription has been found in the chapel, because this absence of any positive indication prevents us from ascertaining the name of the divinity to whom the place was principally dedicated. The only object which I discovered in it was a stone nearly three feet high, conical in shape, of a deep brown color, looking very much like a piece of lava and ending in a sharp point. No attention was paid to it, and I know not what became of it." This description is almost identical with that given by Arnobius and others of the stone from Pessinus.

Another stone of meteoric origin was brought to Rome, and there for a brief period was most fantastically worshiped. This was near the beginning of the third century after Christ. It came, like the other stones of which I have spoken, from Asia. In the city of Emesa, on the banks of the Orontes, about midway between Damascus and Antioch, there was in those days a magnificent temple of the sun. A gorgeous worship was maintained before a stone that fell from heaven that served as the image of the sun god. The description of the stone is not very unlike that of the Cybele meteorite. Herodian, who probably saw it, says: "It is a large stone, rounded on the base, and gradually tapering upward to a sharp point; it is shaped like a cone. Its color is black, and there is a sacred tradition that it fell from heaven. They show certain small prominences and depressions in the stone, and those who see them persuade their eyes that they are seeing an image of the sun not made by hands."

This sun god was named Heliogabalus, and before the altar a boy of nine years of age began to serve as priest. Such a Syrian service did not make the boy grow manly nor virtuous, and when at the age of fifteen he became emperor through the money and intrigues of his grandmother, and the murder of the Emperor Macrinus, we have for three years at Rome the view of the sorriest scapegrace that ever sat on a throne. He assumed with the name of Antoninus also the name of his god Heliogabalus. To the great disgust of the Roman Senate and people, he brought with him from Syria the image of his god, the sacred stone, and himself continued before it his priestly service with all its fantastic forms and gesticulations. He built within the city walls a grand and beautiful temple, with a great number of altars around it; he repaired thither every morning, and sacrificed hecatombs of bulls and an infinite number of sheep, loading the altars with aromatics, and pouring out firkins of the oldest and richest wines. He himself led the choruses, and women of his own country danced with him in circles around the altars, while the whole senatorian and equestrian orders stood in a ring like the audience of a theater.

But now he must have a wife for his god. So he broke into the apartments guarded by the vestals and carried to the palace the Trojan Palladium, or what he supposed was that object, and was intending to celebrate the nuptials of the two images. His god, however, he concluded, would not be pleased with a warlike wife like Pallas; therefore, he ordered to be brought from Carthage an ancient image of Urania, or the moon, which had been set up by Dido when she first built old Carthage. With this image he demanded the immense treasures in her temple, and he also collected from every direction immense sums of money to furnish to the moon a suitable marriage portion when married to the sun.

He built another temple in the suburbs of Rome, to which the Emesa stone, the god (?) was carried in procession every year, while the populace were entertained with games, and shows, and feastings and carousings. Herodian thus describes this performance:

"The god was brought from the city to this place in a chariot glittering with gold and precious stones, and drawn by six large white horses without the least spot, superbly harnessed with gold, and other curious trappings, reflecting a variety of colors. Antoninus himself held the reins—nor was any mortal permitted to be in the chariot; but all kept attendant around him as charioteer to the deity, while he ran backward, leading the horses, with his face to the chariot, that he might have a constant view of his god. In this manner he performed the whole procession, running backward with the reins in his hands, and always keeping his eyes on the god, and that he might not stumble or slip (as he could not see where he went), the whole way was strewn with golden sand, and his guards ran with him and supported him on either side. The people attended the solemnity, running on each side of the way with tapers and flambeaux, and throwing down garlands and flowers as they passed. All the effigies of the other gods, the most costly ornaments and gifts of the temples, and the brilliant arms and ensigns of the imperial dignity, with all the rich furniture of the palace, helped to grace the procession. The horse and all the rest of the army marched in pomp before and after the chariot."

The reign of a foolish boy at this period of Rome's history was necessarily a short one, and at the age of eighteen the soldiers killed him and let the Roman populace have the body to drag through the city streets. The worship of the sun god at once ceased, and, no doubt, the stone also was thrown away. The Cybele stone, however, remained an object of public worship, since the quotation from Arnobius, which I have given, was written nearly a century later than the reign of Heliogabalus.

I propose to speak briefly of one more meteorite whose worship has had a world-wide fame: the image of the Ephesian Artemis. This worship had its center at Ephesus, but was widely extended along the shores of the Mediterranean. Temple after temple was built on the same site at Ephesus, each superior to the preceding, until the structure was reckoned one of the seven wonders of the world. As a temple, it became the theater of a most elaborate religious ceremonial. As an asylum, it protected from pursuit and arrest all kinds of fugitives from justice or vengeance. As a museum, it possessed some of the finest products of Greek art, notably works of Phidias and Apelles. As a bank, it received and guarded the treasures which merchants and princes from all lands brought for safe keeping. In its own right it possessed extensive lands and large revenues. The great city of Ephesus assumed as her leading title that of νεωκορος, or temple-warden of Artemis, putting her name on her coins and in her monumental inscriptions.

The image, which was the central object in this temple, was said to have fallen from heaven. Copies of it in all sizes and forms were made of gold, of silver, of bronze, of stone, and of wood, by Ephesian artificers, and were supplied by them to markets in all lands. What a lifelike picture is given us, in the nineteenth chapter of the Acts of the Apostles, of the excited crowd of Ephesians, urged on by the silversmiths, who made for sale the silver shrines of the goddess, and who saw that their craft was in danger if men learned to regard Artemis as no real divinity, and to despise the image that fell down from the sky!

We cannot suppose that the Ephesian Artemis image of the first century was a meteorite, though we have the distinct appellation, Diipetes, fallen from the sky. But I believe that there was a meteoric stone that was the original of the Ephesian images, and it seems not at all improbable that in some one of the destructions of the temple it disappeared. Or, in the progress of time, there may have been a desire to represent the goddess in a more artistic form than the shapeless stone afforded.

Many forms of the Ephesian Artemis are still preserved, and they have, amid all their variations, a certain peculiar character in common. That common character seems to me to confirm the statement that the original image fell from heaven. This goddess is

regarded, let me say, as different from the Grecian Artemis, the beautiful huntress so well known in Greek art, and I am speaking only of the images of the Ephesian Artemis.

There is one peculiarity in the outward forms of the meteorites that is characteristic of nearly all of them. I mean the moulded forms, and the depressions all over the surfaces. They are better appreciated by being seen than by any description I can give you. They are common to meteorites of all kinds, from the most friable stone to the most compact iron. (I show you one, a stone from Iowa—also the plaster cast of another, a stone from some fall, I know not which one.) Those who have lately visited the collection in the Peabody Museum may recollect the model of an iron that fell two or three years ago in Arkansas, which displays most beautifully these depressions.

Let now an artist attempt to idealize any one of these moulded forms, and to make something like a human shape out of one of them. He must necessarily set it upright, and he must give it a head. You have then a head surmounting one of these moulded forms. Let now the convenience and the taste of the artificers of the images have some liberty to act—and we know that they did act, for we have considerable variety in these images—and a development in the conventional representation of the image is sure to follow.

THE KALAMAZOO CARRYCYCLE.

There are many people in the world who, on account of ill health, deformity or feebleness, cannot find comfortable means for moving about out of doors. They cannot stand the jolting of a carriage, and, frequently, cannot get in and out of one. The push chairs which are in general use answer quite well, but they can only be moved at a slow rate; they are hard to push, and are not as easy and as comfortable to ride in as might be expected. The vehicle which we illustrate is intended to do away with these objections. The invalid sits in a willow chair and rides along on pneumatic tires close to the ground, with nothing in front to obstruct the view. The vehicle is propelled at a quick or slow pace, as desired, by a person having perfect control of the machine, who can run it anywhere to suit the invalid.

As all the revoluble parts are fitted with ball bearings the friction is reduced to a minimum. The carrycycle has a frame constructed with a drop or low upper bar, so that either a lady or gentleman can ride to propel the machine. As in a vehicle of this kind speed is not much desired, the gear is only 45, 50 or 56, and with a low gear the carrycycle propels very easily. On a steep incline the operator can walk and push the machine with the person in the chair much easier than most push chairs can be pushed. By riding behind, the operator has the occupant of the chair constantly in view, which is decidedly the safest and best position, while the invalid or person in the chair has a clear view in front, which is much pleasanter than riding behind the operator, where the view would be obstructed and every exertion of the operator in plain view of invalid. Again, by having the chair in front the chair can sit close to the ground and tilt forward, so that in order to get into it, all any one has to do is to back up to it and sit down. The operator then brings the chair backward to its normal position and secures it by means of a link or hook. The chair rests on flat U-shaped steel springs, one on each axle, and these springs rest on the front axle of the carrycycle in a manner to allow them to pivot when the chair is tilted.

The steering gear is probably the most interesting feature of the vehicle. The cross bars are coupled at their forward ends by ball bearing heads to the front axle, while the rear ends of the cross bars are coupled by ball bearing heads to the rear frame. The tendency of these cross bars, when pushed together, is to cause the machine to go ahead in a straight line. This makes the machine much easier to steer than can be done by any other method. It also allows the machine to be made much more compact, both as regards width and length, than can be made in other ways. By this construction the front wheel, which carries the load, will

THE KALAMAZOO CARRYCYCLE.

yield while passing over obstructions, thereby making it easier for the load or person riding in the chair than it could possibly with a rigid, unyielding axle for the wheels carrying the load. The carrycycle is also provided with a box or cabinet attachment.

We are indebted to the Kalamazoo Cycle Company for the illustrations and particulars for this article.

MILL SET IN MOTION BY AN OX OR HORSE.

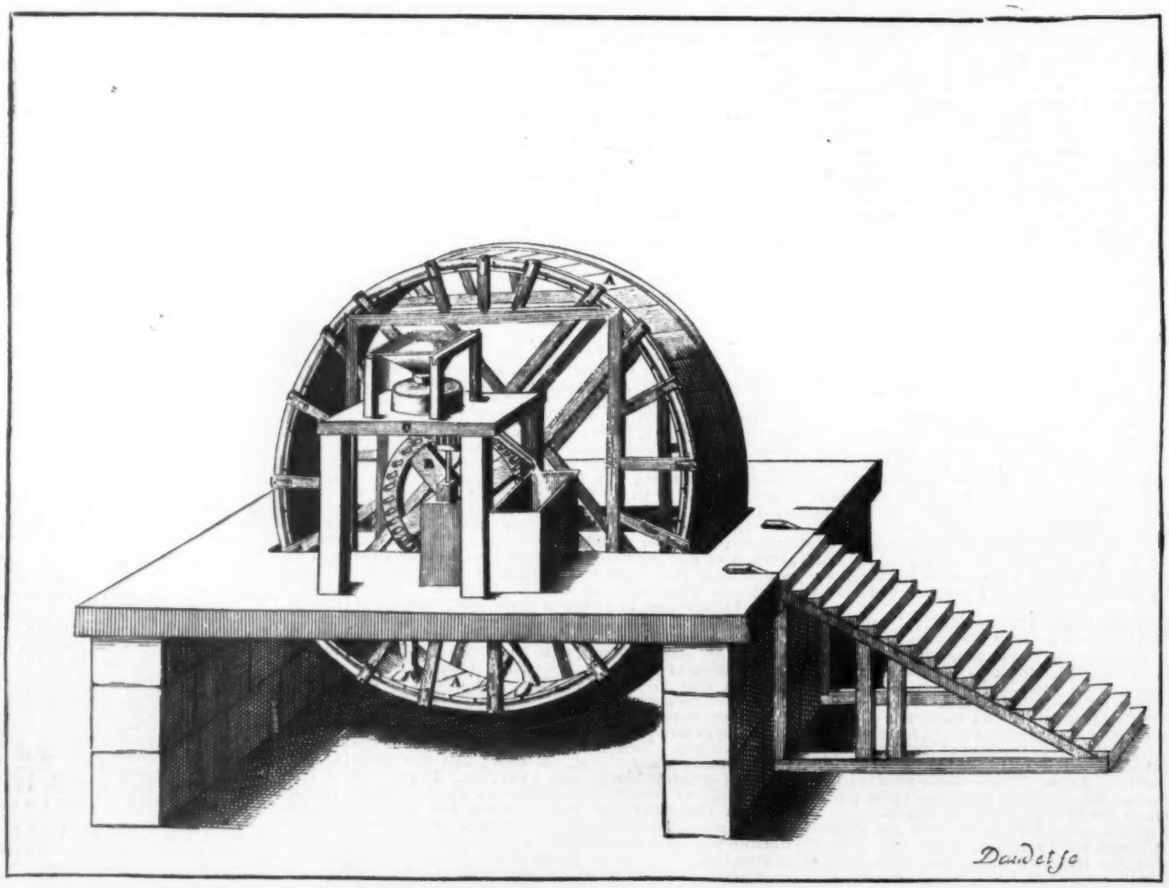
After the large wheel, A, and the rest of the machine shown in the figure has been strongly constructed, an ox that has been previously taught to walk in the wheel is led into it. When the ox effects the motions necessary for walking, he does not change place, but makes the wheel do so; or, to be more explicit, at the part of the circumference upon which his feet rest, he cannot, by reason of the proportion that exists between his weight and the stress necessary to give motion to the mill, move from the line perpendicular to the axis of the wheel in which he is inclosed without causing the latter to revolve.

Thus, the animal, in continuing to revolve the large wheel, A, in this manner, allows the latter to communicate its motion to the face wheel, B, which is at the end of its axle, and consequently to the lantern wheel, C, and the mill stone.—Recueil d'Ouvrages Curieux de Mathematique et de Mecanique, 1733.

AMERICAN MADE MACHINE TOOLS.

One of the most important outcomes of the present dispute in the engineering trade will be, it is generally admitted, the development of machine tools in this country. We believe that already not a few firms have under contemplation the design and erection of automatic machinery for doing work which is now done mainly by hand. The anticipated result is that, in place of the arrangement which now very generally obtains of one workman, one tool, one man will, as in America, be able to attend to several tools at once. The innovation will, of course, be opposed tooth and nail by the trades unions, if there is any fight left in them. They have insisted on the one man, one job arrangement, and as they have had the power to enforce, or the masters have had the complacency to grant the demand, few attempts have been made in this country to bring the automatic tool to anything like the perfection that it has attained in the United States notably, and in Germany to a rather less degree. There can be absolutely no question as to the ability of our mechanicians to invent and make the machines as soon as the restrictions on their use are removed. Let anyone who doubts it consider for a moment the automatic machinery of other classes whose birthplace has been in England. Consider only the wonderful machinery of our cotton mills or of our printing establishments. Could not the engineers who have created and designed such highly automatic machinery as this produce, if necessary, tools which as a rule present far less complicated problems? It is unquestionably true that there are in this country hand worked factories into which mechanical methods, one would imagine, might be introduced with advantage. The manufacture of steel pens may be instanced. At Birmingham the work is almost entirely done by girls and old pattern screw stamping presses. It has been stated that this class of work cannot be done automatically. The statement is hardly credible. The fact is in all likelihood that the effect of throwing a large number of persons out of employment is contemplated with dislike. The existence, therefore, of a few cases of this kind in no degree disproves the ability of the Englishman to invent the machinery required.

The use of the machine tool in America is entirely unrestricted. The development of it has, therefore, made great strides. The importation of American tools into this country need not, however, be regarded with the slightest uneasiness. We have not the least hesitation in saying that many English firms can and will produce tools as good as those now being imported. The American tool is not entirely adapted to English work, and in certain respects is distasteful to the British workman. It would not be easy to say why in all cases. The matter is one of taste, just as a Scotchman blows his bagpipes with his mouth while an Irishman blows his with his elbow. Equally attractive music is to be got out of both, but heredity prejudices each nation in favor of a particular type. In other cases it is perfectly easy to account for the Englishman's dislike. One or two of these reasons we may point out. A noticeable feature of American tools is the shortness of crank handles or their replacement by little wheels. We do not question that the American arrangement is designed to give the same power approximately as the English device. To the English mind, however, it does not give the same sense of power and security. Moreover, the control is unquestionably less complete, and the labor is rather increased if any-



MILL SET IN MOTION BY AN OX OR HORSE.

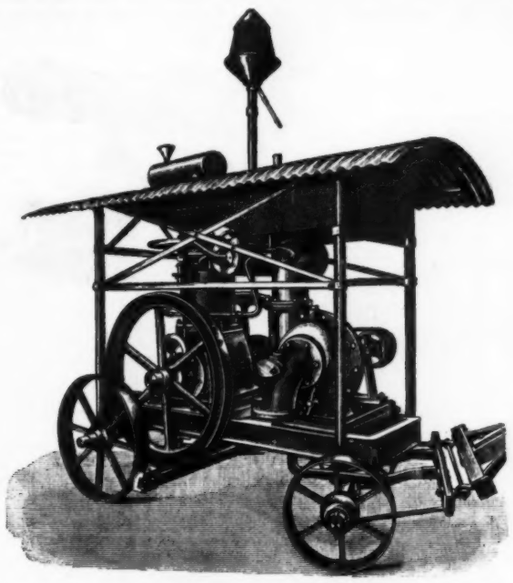
thing. Not long ago we saw a large American lathe by a well known firm at work. It was in many respects an excellent tool. The foreman in charge of it said he believed it was a good machine, but nevertheless he did not like it, and never felt quite at home with it. One of his chief objections was that whereas he was accustomed to a long rack handle always well within reach of hand or toe, and having a good, steady working leverage, the tool under discussion had quite a short counterbalanced handle, and not only needed many rotations to run the slide rest back, but, as we have said, left the operator without the sense of the power of controlling his machine. There are other points, too, which a cursory examination reveals. The most potent is the use of a simple instead of a compound rest on lathes fitted with taper gear. Practically all English lathes have two hand screws on the rest, giving motions normally at right angles, one parallel with and the other perpendicular to the lathe centers. The American, however, uses the latter only. Now in English shops the former gear is used universally for adjusting the cut when facing, and the absence of it is consequently embarrassing. The American does the same thing by clamping down the lead nut and turning the leading screw by hand. We do not doubt that very good work can be done in this way—our cousins are excellent mechanics—but it does not strike one as being so convenient as the method to which we are accustomed, and from which we shall not depart readily. Other points in which American and English practices differ will occur to users and makers of machine tools. We think most of our readers will agree with us that the Englishman prefers an English made tool.

We are none the less perfectly ready to admit that American tools are in many respects ingeniously devised and excellently constructed. Makers in this country have much to learn from them; that they will learn much and turn their knowledge to good account we do not doubt for a moment. In making his designs the Englishman will find that the American practice is unsuitable in several respects. It must not be forgotten that American cast iron is a far softer material than ours. Higher speeds and greater feeds can, in consequence, be used than are ever employed here. The very same fact renders alteration in the design of the main castings of a machine necessary. Besides these vital points there are less important details which need observance if outrage is not to be done to the conservatism of English engineers and mechanics. On the whole, therefore, a slavish copy of American tools is as little likely to make much progress in this country as the original tools themselves. We want automatic machine tools, but we want them stamped with our own and not American characteristics.—London Engineer.

NEW GASOLINE MOTORS.

AT the Hungarian Millenary Exposition held recently at Budapest, Messrs. Ganz & Company exhibited some interesting gas motors that are worthy of notice. These motors are of the Banki & Csonk type, with distribution by valves. Those of two horse power especially are now largely used in agricultural exploitations for cutting straw, slicing beets, grinding wheat, churning, etc. They are usually coupled with a pump for raising water.

TWO HORSE POWER GASOLINE MOTOR.



TEN HORSE POWER GASOLINE MOTOR COUPLED WITH A CENTRIFUGAL PUMP.

The gasoline engine represented in Fig. 1 is of the two horse power type. The gasoline reservoir is placed upon the motor and the cooling of the water is effected by means of a fan mounted upon the side of a large iron plate box that carries, in addition, a small centrifugal pump keyed upon the same axle. The suction pipe of this pump descends to the bottom of the box, while the force pipe is connected with the jacket of the cylinder. The forcing of the water, which is heated in contact with the cylinder jacket, is effected through a pipe that starts from the upper part of the box, where it is provided with a rose that divides the water and allows it to fall back in a fine shower. The draught is produced by the fan in an opposite direction and cools the water, which collects at the lower part of the box, whence it is sent anew around the cylinder. It is always the same water that circulates. It is necessary, however, to make additions to it in order to compensate for losses due to evaporation.

The engine that we represent in Fig. 2 is provided with two ten horse power cylinders that actuate a large centrifugal pump. The gasoline reservoir is placed upon the roof of the vehicle, and the cooling is effected directly by means of the pump, the force and suction pipe of which are connected respectively through branches with the cylinder jacket and cover. A small reservoir serves to effect such cooling when the motor is running without the pump.

In the locomotive engines, which operate in most cases in the open air, the suppression of an external flame for ignition is advantageous in every respect.—Revue Industrielle.

PADDLE ENGINES WITH JOY GEAR.

WE publish an engraving of a set of paddle engines constructed by Messrs. Alley & Maclellan, of Sentinel Works, Polmadie Road, Glasgow. These engines, which are noticeable from being fitted with Joy valve gear, are of the triple expansion jet condensing type, and have cylinders 18¼ in., 28½ in. and 45 in. in diameter respectively, with 48 in. stroke. They are designed to indicate 600 horse power at 50 revolutions per minute, with a boiler pressure of 150 lb. per square inch.

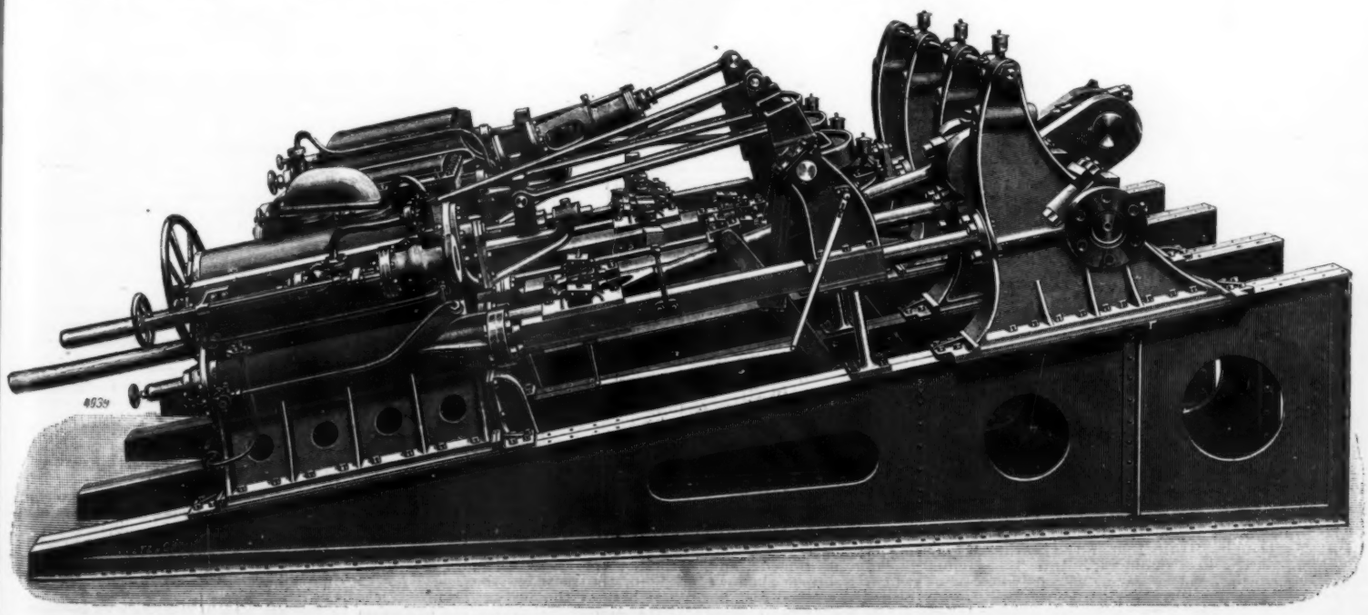
The crankshaft is built of Siemens-Martin steel, and is fitted with Alley's patent flexible coupling. The paddle wheels are of the usual feathering type.

The valve gear is of the Joy radial type, the reversing gear being arranged with steam and hydraulic cylinders worked by a handwheel from the back of the cylinders, arranged in such a manner that combined steam and hand gear, or steam gear only, or hand gear only, can be utilized for reversing purposes.

All the pumps are auxiliary, the feed and bilge pumps being of the duplex type. The air pump is a drum pump driven by a tandem compound engine.

The engines are designed for light draught steamers, the engine frames being built up of steel plates and solid double angle frames, for the purpose of stiffening the hull.—Engineering.

The difference between rising every morning at six and at eight in the course of 40 years amounts to 29,200 hours, or 3 years 121 days and 16 hours, which are equal to eight hours a day for exactly ten years, so that rising at six will be the same as if ten years of life were added.



SIX HUNDRED HORSE POWER PADDLE ENGINES WITH JOY VALVE GEAR.

THE BRIDGES-LEE PHOTO-THEODOLITE.

THE idea of using the camera as a surveying instrument has occurred independently to quite a number of engineers, though apparently the honor of being the pioneer in the matter must be conceded to Colonel Laussedat, of the French army. The credit of introducing the system on an extensive scale for the production of topographic plans must, however, be awarded to Mr. E. Deville, the surveyor-general of Dominion lands, who has introduced the method very extensively into his department; no less than 14,000 square miles of territory being thus surveyed during 1893 and 1894, in connection with the settlement of the international boundary between Canada and Alaska. Since then the method has been adopted more or less extensively in the United States, and in its own special department seems likely to oust all rivals. One great advantage of the camera as a surveying instrument lies in the fact that it is much less dependent on the weather than is a plane table, this latter being the particular instrument with which it more especially compares. With the plane table all work must be done in the field, while with the camera, the whole of the plotting being done in the office, the wet and dull days of winter can be used to work up the photographs taken during the finer summer weather. In the Rocky Mountains, Mr. Deville states, plane table work costs at least three times as much as a camera survey. Moreover, with the latter it is possible to make first a rough plot showing only the more prominent features of the ground, and then, if later on a more detailed plan is required, this can be made from the original photographs without necessitating a fresh visit to the ground. As with the plane table, any required degree of accuracy can be obtained by multiplying the photographs taken.

The principle on which the method is based rests upon the geometric truth that if the bearing of any individual object on a photograph from the camera station is known, then the bearing of every other point shown on the print can be calculated, if the focal length of the lens is known. Two photographs being taken of the same landscape from two different stations, and the distance and relative bearing of these two being known, then the whole landscape can be plotted by means of intersections, just as in plane tabling, but with the photographic method the whole of the work can be done at ease in the office.

Special cameras have been devised to simplify the work, the essentials being a method of marking on the negative a vertical and a horizontal line intersecting on the axis of the lens. The bearing of the optic axis may be obtained from a compass, and noted at the time the exposure is made. A more convenient method has, however, been devised by Mr. Bridges-Lee, of 6 King's Bench Walk, E. C., who places a compass, having its divisions engraved on a vertical ring of transparent celluloid, inside the camera in such a position that the bearing of the optic axis is automatically recorded on the plate at the same time the exposure is made. A camera thus constructed was described in our issue of July 31, 1896. More recently Mr. Bridges-Lee has made further additions to the instrument, which, as made by Mr. L. Casella, of 147 Holborn Bars, E. C., now takes the form shown in our engraving. The body of the camera is of aluminum, and fits on to a theodolite base below, while at the top is a telescope, small, but of excellent quality, which enables the instrument to be used as an ordinary theodolite when desired, large vertical angles being observed when necessary by a prism or mirror attachment. The divided horizontal circle enables azimuth readings to be made to half a minute of arc, a vernier and reading microscope being fitted as shown. The latter is carried on a telescopic arm and can also be used for reading the compass bearing through a window in the focusing screen. The level shown at the top of the camera moves on a circular run, and enables the instrument to be leveled without necessitating the turning of the camera as a whole. Inside the camera is a frame sliding on ways, and carrying in the first place the compass already mentioned; and, secondly, the cross wires, which by their shadows mark on the negative the principal vertical and horizontal lines of the picture. When a slide is in place and the shutter withdrawn, the frame already mentioned is moved up by the milled head shown to the right of the camera, until its edges are in contact with the sensitive plate. The latter is then carried back with the frame until further motion of the latter is arrested by fixed stops, so that, whatever the thickness of the plate, the distance of the sensitive surface from the lens is always the same. The cross strip shown attached to the back of the frame is of glass, and carries an accurate tangent scale, which enables the horizontal angle which any object shown on the print makes with the optic axis to be determined directly by the use of a parallel ruler or a pair of dividers. The two little strips of celluloid shown below and at either end of the tangent scale are removable, and on them can be written previous to taking the photograph such data as the camera station, its number and elevation, date, etc., all of which will then be reproduced on the negative, and thus any possible danger of confusing two negatives on the subsequent plotting is totally avoided. The information recorded on a negative in this way is shown in Fig. 2, which is reproduced on the sky of each negative. The lens adopted is of the rectilinear type, and is used with a fixed focus and a very small stop. In order to avoid photographic haze, which tends to render distant objects indistinct, isochromatic plates and a yellow or green screen are made use of, and with this precaution there is no difficulty in getting sharpness in the "distance" of the picture.

To secure the stability of the instrument during the long exposure entailed by the use of this screen and the small lens aperture adopted, it is usual in Canada to carry a net, which is hung on the camera tripod when set up and filled with stones, the precaution being taken of letting the bottom of the net just scrape the ground, as otherwise it would swing with the wind and cause shaking.

Having obtained a plan of a survey in the way described, the introduction of contour lines is not difficult, since the distance of any particular point from the camera station is then known, and its depth above or below the horizon line in the print is a measure of its angular elevation or depression as observed from the camera station. The level of a few points being thus ascertained, the contours can be filled with considerable accuracy by estimation from the appearance of the photograph.—Engineering.

Fig. 1.

Fig. 2.

THE BRIDGES-LEE PHOTO-THEODOLITE.

LABELS FOR DRY PLATES.

PROBABLY a considerable number of readers will now be planning their Continental trip, and there will be even among the oldest travelers a certain amount of fear—"Shall I get my plates through safely?" Especially will this be so if one's vocabulary is bounded by the "Have you the pens, ink, and paper?" limitations, which with the aid of native hospitality may be sufficient to provide the necessaries of life when once we are in the country itself, but will scarcely enable us to explain the contents of that mysterious parcel of plates or films to the Custom House officials. The best way then is to have a few labels printed and gummed so that they may be stuck on to each package of sensitive material, and which, with the truthful expression which the photographer always wears, will satisfy the officers that no dynamite, or tobacco, or matches, or tea, or India rubber soled boots are being smuggled in. Here is a list of the inscriptons for the various countries:

FRENCH.

CRAINT LA LUMIERE.
N'OUVRIR QU'EN PRESENCE DU DESTINATAIRE.

GERMAN.

FURCHET DAS LICHT.
NUR ZU OFFNEN IM GEGENWART DES EMPFANGERS.

ITALIAN.

TEME LA LUCE.
APRIRE IN PRESENZA DEL DESTINARIO.

NORWEGIAN.

MAA IKKE UDSOETTES FOR DAGSLYSET.
OG KUN AABNES I ADDRESSATRUS NOEVOERSE.

SPANISH.

TEME LA LUZ.
ABRIR SOLO EN LA PRESENCIA DEL DESTINATARIO.

DUTCH.

MAGNIET AAN HET DAYLICHT BLOOTGRETELD WORDEN. VERZOEKE NIET TE OPENEN DAN IN THGENWOOZ—DICHEILD VAN DEN GRADRESSEERDE.

—The Amateur Photographer.

ON GAMBIER-FLUORESCIN AND GAMBIER-CATECHU RED.

By KARL DIETERICH.

THE author has stated before that gambier-catechu, in contradistinction to pegu-catechu, contains a fluorescent body whose character he now describes more closely. The same is called gambier-fluorescin and is of a highly decomposable nature, for which reason it could not be obtained isolated pure, but only in solution. It is a basic body, which passes into a red resin by oxidation in the air, which Dieterich names gambier-catechu red. The gambier-fluorescin is not con-

tained in a free state in the catechu, but is apparently combined with catechine and catechu tannic acid, in the same way as ester. By carbonic or caustic alkalies, however, it is readily split off and can then be shaken out with benzine or ether, besides two other bodies of an oil-like and waxlike nature. The gambier-catechu red is not similar to pegu-catechu red already known. It melts at 130°–131° C., is almost insoluble in ether, and is no longer, like the fluorescin, of purely basic character. It can be acetylized and has a percentage of acid of 95·2, while the ester number was 30. Owing to the fact that only 1 gramme of catechu red could be obtained from 5 kilogrammes of gambier, the investigation has not very far advanced.

The fat oil above mentioned contained 14·89 per cent. of acid and 43·33 per cent. of ester, while the percentage of iodine is exceedingly small. The small quantity of this substance, as well as of the wax also present in catechu, makes a more accurate examination impossible for the time being.—Ber. Pharm. Ges.

THE CHIME AT ST. GERMAIN L'AUXERROIS.

FORMERLY, when church chimes were rung by hand, it was always effected by maneuvering the clappers inside the bells by the aid of pedals and of keys arranged on a sort of keyboard.

The old automatic system consisted of a metallic cylinder covered with numerous projecting pins, and rotated by a clockwork movement. In revolving, this cylinder raised, by means of the pins on its surface, the levers, which were connected by wires with the clappers; and the latter, on falling back against the bells, produced the tones necessary to play the desired airs.

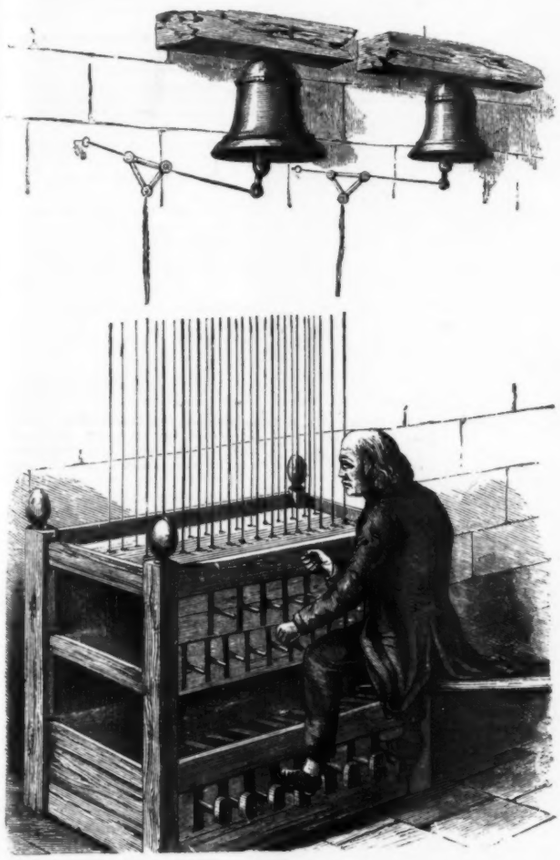


FIG. 1.—KEYBOARD CHIME—OLD SYSTEM.

When it was desired to obtain very powerful tones and to play tones of some length, an enormous power had to be expended. By the aid of the keyboard and its attachments it was necessary, in fact, to raise clappers, which in some cases were extremely heavy, and to overcome a resistance that could be surmounted only by great trouble, and that too by striking with the fists on the keys and with the feet on the pedals. (Fig. 1.) When this automatic cylinder was employed, it was necessary (owing to the fact that it had to raise heavy clappers) to give it dimensions varying from 3½ to 6½ feet in diameter, and a very considerable rotary power. To actuate these machines, weights of from 1,000 to 6,000 pounds were employed. These were suspended from chains rolling around drums, and were wound up by means of windlasses, requiring the labor of from one to three men for one or two hours. The chime of the Samaritaine, at Paris (destroyed in 1813), was on this system. At Bruges, Belgium, there is a very perfect chime of the same kind. It is provided with a bronze cylinder weighing no less than 22,000 pounds, and representing a value of $8,000 for the metal alone These old fashioned chimes, as may well be seen, were very costly and inconvenient. They utlized at the very most only 30 per cent., or at the least one third of the force expended. This will be readily understood if it be taken into consideration that the cylinder, always revolving with the same speed, expends as much power to sound a 6 pound bell as to strike a large one weighing 6,000 pounds.

The chime in the tower of Saint Germain l'Auxerrois, at Paris, differs essentially from those above described and marks a great progress in the manufacture of these apparatus. It consists essentially of: (1) sets of wheels and weights equal in number to that of the bells and of power porportionate to the weight of the latter; (2) of a keyboard similar to that of a piano and operated the same way; (3) of a cylinder for playing automatically, of about 16 inches diameter, so arranged that it can be removed and replaced by others affording other tunes. The importance of the revolution effected in the mechanism may be realized when we state that this chime, instead of needing the labor of two or three men during a part of a day for winding it up, requires but the labor of one man for ten minutes each week to wind up the weights connected with the automatic part, which is arranged to play four airs per day. Fig. 2 shows the chime as now definitely located in the tower of St. Germain l'Auxerrois.

In the old system of chimes there was but one mechanism for all the bells, but in this each bell has a special set of motive wheels of a power proportioned to the weights. As each set of wheels can operate only when it is desired to obtain the sound of the bell connected with it, it uses its power only when it acts. The manufacturer has based his calculations of the motive weights on data from experiments, which have shown that, in large bells giving the bass tones in the chimes, the effort necessary to raise the clappers is about equal to a hundredth of the weight of the bells; a bell of 4,000 pounds, for example, requiring an effort of 40 pounds. But in the small bells the effort is relatively greater in proportion to their weight, and may be estimated at about one-fifth; so that for a bell of 20 pounds, for instance, an effort of 4 pounds would be necessary. As may be seen, then, this division of the weights and sets of wheels affords considerable economy in motive power. This arrangement, moreover, has the advantage that the wheels operate with sufficient speed to allow passages to be readily played which contain quavers and semiquavers.

Finally, it may be remarked that one of the characteristic features of this chime is that the operations of the automatic cylinder are effected without any outside aid—the mechanism once wound up taking care of itself.

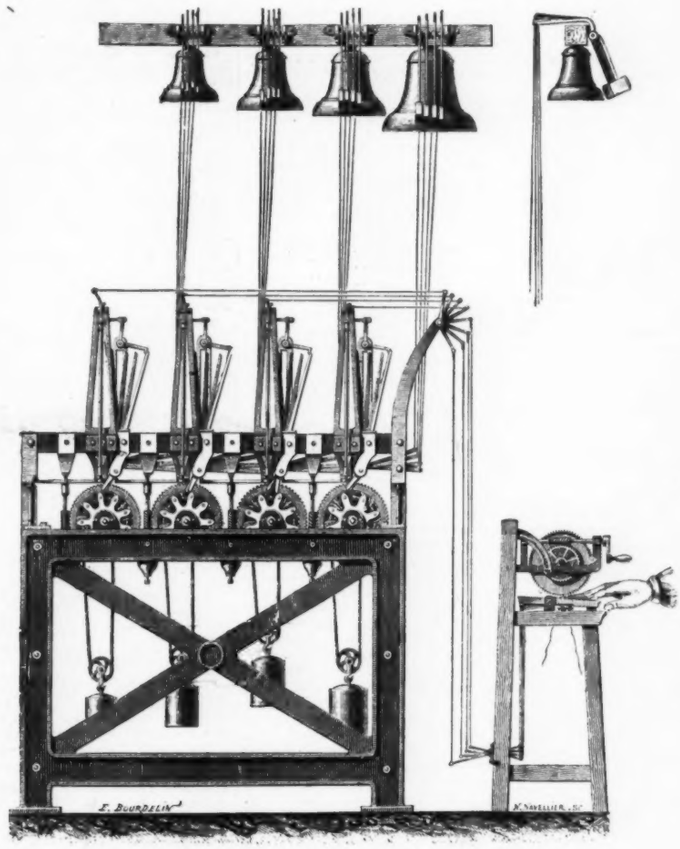


FIG. 2.—NEW CHIME OF SAINT GERMAIN L'AUXERROIS.

DETECTION OF TAR DYESTUFFS IN CLARET.

SULPHIDE of zinc forms a very stable lake with the dyestuff of wine, of bilberries, mallows, as well as with archil, litmus and cochineal, while tar dyestuffs can be very easily abstracted from the mixture with alcohol or water. This behavior of the sulphide of zinc forms the basis of a new method of isolating tar dyestuffs from claret. Not every sulphide of zinc can be used. Most advantageous was found the preparation which is obtained from a chloride of zinc solution mixed with ammonia in excess by precipitation with a sufficient volume of sulphide of hydrogen. The precipitate is washed until free from chlorine and dried at a temperature kept below 35° Cent. To test claret for tar dyestuffs, grind five grammes of sulphide of zinc in enough wine so that a scarcely liquid mixture ensues, then add a little water until the mixture is fluid; allow to deposit, filter and abstract. In case the fluid appears colored, clear the dyestuff by washing with water. The colored filtrate is evaporated, the residue extracted with 90 per cent. alcohol, and the filtered solution once more evaporated to dryness. The dyestuff can now be dissolved with alcohol and used for identity reactions. If the dyestuff of the sulphide of zinc-wine mixture does not pass into the water, treat the filter residue again moist with the same volume of 90 per cent. alcohol, heat moderately while stirring, filter and abstract the dyestuff by washing with alcohol. Indigo carmine, which can be isolated by means of water, behaves in the same manner as tar dyestuffs. Alcohol, however, easily abstracts them if they are soluble in it. Otherwise a like volume of alcohol is poured over the moist precipitate in a porcelain dish, in such a manner that the mixture does not wet the walls above it of the vessel. If the liquid is evaporated without stirring, dissociation of the lake will set in and the dyestuff will adhere to the wall of the dish. The evaporation is continued to dryness, the sulphide of zinc removed from the dish and the dyestuff dissolved with water. This abnormal behavior was observed only with three blue tar dyestuffs. According to the described method it can be readily ascertained whether fuchsine or a sulphur acid is present, as the latter is already soluble in water; fuchsine, however, only in alcohol. For the identification of the different dyestuffs the author has compiled an extensive table.—Chemiker Zeitung, from Rev. Chim. Anal. Appliq., 1897, 5, 62.

METHOD OF PRODUCING INCANDESCENT MANTLES.

SUCH a mantle is obtained, as has been shown by the incandescent light patent suits (Chem. Ind.), by saturating the knit cotton hose with a 30 per cent. solution of the nitrates of thorium and cerium (99:1), drying in the air and incinerating. The ashes at first are entirely soft and flexible; by annealing by means of suitably shaped pressed gas burners the substance is caused to slag and harden, and at the same time it is given the bell-like shape. Now the mantle is hung up, by means of an asbestos thread drawn through its head, upon a magnesia pencil in the middle of the burner (commonly iron pencils were used). To take the place of the magnesia pencils, of late pencils of fire clay have been introduced in the market; as the former, being made of finely ground magnesite and exposed to strong white heat, frequently slake in damp air and consequently quickly crumble into dust. The highest illuminating power of the mantles is dependent on the proportion of alumina 99 and cerium earth 1. An increase of the percentage of cerium changes the white light of that mixture more and more into yellow; pure nitrate of thorium is luminous in the Bunsen flame only with a dead, red-violet, pale light; likewise nitrate of cerium alone or mixed with up to 70 per cent. thorium only gives off a dark, blood-red to orange-red light. Important is the production of pure salts of thorium and cerium, which are at present prepared from the monazites. The separation of cerium from didymium and lanthanum is considered particularly difficult, and for this purpose Mozander's process, modified by O. N. Witt, is recommended. The raw dioxide of cerium thus obtained is dissolved in nitric acid, nitrite of ammonium added, and the nitrate of ceriammonium is allowed to crystallize out. These orange-red crystals, reduced in an aqueous solution with alcohol and evaporated, yield the beautifully crystallizing ceriammonium used in mantles as nitrate of cerium.

Rhinometers are devices to measure the amount of air a man breathes through his nose, in order that his doctor may compare it to the amount he should take in that way.

SELECTED FORMULÆ.

Soldering Aluminum.—Another new solder for aluminum has been brought out in the United States under the title of Green's aluminum solder. It is stated to be composed of zinc, 50·03 per cent.; tin, 47·99; aluminum, 1·76; and phosphorus, 0·22 per cent. It is not used with any flux, simply requiring the aluminum faces to be cleaned and coated with the solder, then a clean hot bit is used to wipe the joint to be made.

Tanning Hides for Robes.—The hides should be very thoroughly soaked in order to get a complete softening. For dry hides this will require a longer time than for salted. A heavy hide requires longer soaking than a skin. Thus, it is impossible, says Hide and Leather, to fix a certain length of time. After soaking, the hide is fleshed clean, and is now ready to go into the tan liquor, which is made up as follows: One part alum, 1 part salt, ¼ to ½ part japonica. These are dissolved in hot water in sufficient quantity to make a 35° liquor. The hide, according to the thickness, is left in the tan from five to ten days. Skins are finished in about two or three days. The hide should be run in a drum for about two hours before going into tan, and again after that process. In tanning hides for robes, shaving them down is a main requisite for success, as it is impossible to get soft leather otherwise. After shaving put back into the tan liquor again for a day or two and hang up to dry. When good and hard, shave again and lay away in moist sawdust and give a heavy coat of oil. When dry, apply a solution of soft soap; roll up and lay away in moist sawdust again. Now run the hides on a drum or wheel until thoroughly soft. The composition of the tan liquor may be changed considerably. If the brownish tinge of the japonica be objectionable, that article may be left out entirely. The japonica has the effect of making the robe more able to resist water, as the alum and salt alone are readily soaked out by rain.—Shoe and Leather Facts.

Spots on Cigars.—The speckled appearance of certain wrappers is due to the work of a species of fungus that attacks the growing tobacco. In a certain district of Sumatra, which produces an exceptionally fine tobacco for wrappers, the leaves of the plant are commonly speckled in this way. Several patents have been obtained for methods of spotting tobacco leaves artificially. A St. Louis firm uses a solution composed of:

Sodium carbonate	3 parts.
Calx chlorinata	1 "
Hot water	8 "

Dissolve the washing soda in the hot water, add the chlorinated lime and heat the mixture to the boiling temperature for three minutes. When cool, decant into earthenware or stoneware jugs, cork tightly and keep in a cool place. The corks of jugs not intended for immediate use should be covered with a piece of bladder or strong parchment paper, and tightly tied down to prevent the escape of gas, and consequent weakening of the bleaching powder of the fluid. The prepared liquid is sprinkled on the tobacco, the latter being then exposed to light and air, when, it is said, the disagreeable odor produced soon disappears.—American Druggist.

Development of Fruit Flavors.—Some very interesting and suggestive results have been obtained by Jacquemin, who finds that by the addition of the leaves of fruit trees, which in themselves have no marked flavor, to saccharine solutions undergoing alcoholic fermentation, a very marked bouquet of the fruit is developed. Thus by immersing pear or apple tree leaves in a 10 or 15 per cent. solution of sugar, and adding a pure yeast, which by itself gave rise to no marked flavor, after fermentation a liquid was obtained which had a strong odor of pear or apple respectively and an excellent flavor, and on distillation gave an alcoholic distillate, in which this aroma was still more marked. Vine leaves act in a similar manner, and the author suggests that it may be possible to improve the bouquet of a poor vintage by the addition of some leaves during fermentation. It is noteworthy that the results are far more marked when the leaves employed are from trees in which the fruit is approaching maturity. The author infers that the flavors of fruits are due to a body elaborated in the leaves, possibly of a glucosidal nature, which is not transferred to the fruits until the latter approach maturity, and is then acted upon by the special ferments contained in the fruit juices and develops distinctive flavors. The matter would appear to be of considerable practical importance.—Pharmaceutical Journal.

An Ever-Ready Pad for Rubber Stamps.—The following is said to be a cushion that will give color permanently. It consists of a box filled with an elastic composition, saturated with a suitable color. The cushion fulfills its purpose for years without being renewed, always contains sufficient moisture, which is drawn from the atmosphere, and continues to act as a color stamp cushion so long as a remnant of the mass or composition remains in the box or receptacle. This cushion or pad is too soft to be self-supporting, but should be held in a low flat pan and have a permanent cloth cover. The composition consists preferably of 1 part gelatine, 1 part water, 6 parts glycerine, and 6 parts coloring matter. A suitable black color can be made from the following materials: 1 part gelatine glue, 3 parts lampblack, aniline black, or a suitable quantity of logwood extract, 10 parts of glycerine, 1 part absolute alcohol, 2 parts water, 1 part Venetian soap, 1-5 part salicylic acid. For red, blue or violet, 1 part gelatine glue, 2 parts aniline of desired color, 1 part absolute alcohol, 10 parts glycerine, 1 part Venetian soap, and 1-5 part salicylic acid. The following are two additional receipts used for this purpose: 1. Mix and dissolve 2 to 4 drachms aniline violet, 15 ounces alcohol, 15 ounces glycerine. The solution is poured on the cushion and rubbed in with a brush. The general method of preparing the pad is to swell the gelatine with cold water, then boil and add the glycerine, etc.

Formaldehyde for Mosquitoes.—Dr. Henry Liston, of Sunderland, states that while on the Zanzibar coast he used a 40 per cent. solution of above for mosquito bites with remarkably quick and good results. It should be applied to the bites as soon as possible with the cork of the bottle, and allowed to dry on.—Western Drug.

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